

Evaluation Report of 2018-2019 Home Energy Reports Program

ROCKY MOUNTAIN POWER IDAHO

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Executive Summary

Since 2014, the Home Energy Reports (HER) program has been sending home energy reports to residential customers of Rocky Mountain Power Idaho. These reports contain information about the customer's home energy consumption and encourage the adoption of energy-saving behaviors and home improvements.

The HER program evaluation used a randomized controlled trial (RCT) design to randomly assign eligible customers to either a treatment group (that receives the home energy reports) or a control group (nonrecipients). Treatment group customers were either mailed or emailed the HERs.¹ The program also provided all residential customers (including those in the control group) access to an online energy management portal where they can view details and insights about their home energy use; however, neither treatment nor control group customers received specific encouragement in the HERs to use the online portal. Control group customers did not receive the HERs; therefore, this group's consumption provides a baseline for measuring the HER program's energy savings.

From 2014 through 2017, Oracle Utilities Opower served as the implementation contractor and delivered the HERs to customers. In 2018, the HER program made the transition to a new implementation contractor, Bidgely. For the 2018-2019 program, Bidgely maintained the treatment and control group assignments that Oracle Utilities Opower had established and launched a second HER experiment in 2019.

All treatment and control group customers belonged to one of two cohorts of customers known as "waves" that were based on when customers began receiving the HERs:

- Legacy wave received the first report in 2014
- Expansion wave received the first report in 2019

In 2018, treatment group customers in the Legacy wave received either three print HERs or five email HERs, depending on the availability of a valid email address for the customer. During the transition to Bidgely, there was a gap in treatment of four months in 2018 when customers only received one HER. After July 2018, customers received two more paper HERs in 2018 and monthly electronic treatment. In 2019, treatment group customers in both waves received either four print HERs or monthly email HERs.

The new HERs from Bidgely contained a similar homes comparison, end-use disaggregation by appliance, historical energy consumption trends, and personalized energy-saving tips. All report components, except for the end-use disaggregation information, were found in the previous implementation contractor's HERs.

¹ Customers with a valid email address receive the HERs via email while customers without a valid email address receive print HERs via mail.

Cadmus and PacifiCorp identified the following research objectives for evaluating Rocky Mountain Power Idaho’s 2018 and 2019 HER program:

- Evaluate program impacts on energy consumption and gain insight on program performance
- Investigate the lift in other Rocky Mountain Power energy efficiency program participation and energy savings from the HER program (program uplift)
- Understand customers’ satisfaction with the HER program and awareness of their energy consumption and other energy efficiency programs
- Determine if the HER program was cost-effective each year and across both years
- Review the extent to which PacifiCorp implemented recommendations from previous evaluations

Through interviews with program staff, customer surveys, billing analysis, uplift (energy efficiency program participation and savings) analysis, and cost-effectiveness analysis, Cadmus addressed the evaluation research objectives.

Conclusions and Recommendations

Table 1 shows the program total savings reported by the HER vendor and the program total savings and total uplift savings evaluated by Cadmus for 2018, 2019, and both years combined. Before adjusting savings for uplift, Cadmus evaluated 95% of the reported savings. However, 90% confidence intervals around the evaluated savings included the reported savings, indicating that the two estimates were not statistically different. Across both 2018 and 2019 program years, savings uplift in downstream programs contributed 1.9% to the evaluated savings. There was no detectable lift in Idaho’s upstream lighting program savings from the reports.

Table 1. 2018-2019 Program Total Reported and Evaluated Savings

Program Year	Reported Savings (MWh/yr) [A]	Evaluated Savings (MWh/yr) [B]	Realization Rate [B/A]	Program Uplift Savings		Evaluated Savings Adjusted for Uplift (MWh/yr) [B – C]
				(MWh/yr) [C]	(%) [C/B]	
2018	2,802	2,544	91%	76	2.98%	2,469
2019	3,406	3,377	99%	36	1.06%	3,341
2018-2019 Program	6,208	5,921	95%	112	1.89%	5,809

Cadmus’ evaluation drew the following conclusions and recommendations:

Savings and Uplift

Rocky Mountain Power’s HER Program in Idaho saved significant amounts of energy in 2018 and 2019.

Across the two waves of treatment, the program saved 2,544 MWh/yr in 2018 and 3,377 MWh/yr in 2019 before adjusting for uplift. The longest-running wave, Legacy, which launched in late 2014, achieved significant savings of 1.3% of consumption in 2018 and 1.6% of consumption in 2019. The newest wave, Expansion, did not achieve statistically significant savings in 2019, probably because it was only in its seventh month of treatment, having launched in June 2019.

In 2018 and 2019, Legacy wave customers increased their savings compared to the levels observed in 2017. Legacy wave customers saved 1.3% of consumption in 2018 and 1.6% in 2019, an increase from the savings of 1.2% in 2017. Legacy wave customers, who had received treatment since late 2014, appeared unaffected by the gap in treatment at the beginning of 2018 when PacifiCorp changed HER vendors.

Expansion wave customers achieved lower savings in 2019 compared to the Legacy wave after the same length of treatment; however, Expansion wave customers have lower consumption levels. The Expansion wave saved 0.6% of electricity consumption in the first year of treatment in 2019. These savings were lower than those achieved by the Legacy wave during its first year (1.2%) of treatment. The lower savings may be explained by differences in consumption between the waves. The Expansion customers had lower consumption (25.3 kWh/day for the control group) compared to the Legacy wave (41.3 kWh/day for the control group).

The HER program had small effects on participation in and savings from Rocky Mountain Power's downstream rebate programs. Across both waves, HER treatment increased the average savings from energy efficiency program participation by 5.63 kWh/yr per customer in 2018 and 1.74 kWh/yr per customer in 2019. Total uplift from downstream programs constituted small percentage of evaluated program savings—in 2018 only 3.0% of evaluated program savings resulted from downstream program participation, and in 2019 these savings decreased slightly to 1.1%. Downstream uplift results aligned with findings from the customer survey that treated and control customers were equally familiar with Rocky Mountain Power Idaho's energy efficiency programs. The reports did not promote energy efficiency programs.

Report Engagement and Influence

Nearly all customers read the HERs and found the information in the reports helpful or useful; nonetheless, opportunities exist to increase customer engagement with the reports. In the surveys, 38% of respondents said they read the last report they received thoroughly, 30% read some of the report, and 29% skimmed the report. A high proportion of respondents agreed with the following: the reports are easy to understand (90%), the information in the reports is helpful (82%), they believed the usage information shown in the reports was accurate (71%), they had applied some of the everyday tips recommended in the reports (67%), and the tips were relevant to their home (61%). However, more respondents tended to say they *somewhat agreed* than *strongly agreed* with these statements, suggesting that the HERs could still be improved to further increase customer engagement with and confidence in them.

Notwithstanding the results of the impact analysis showing energy savings from HERs, treatment group customers reported adopting energy-saving practices at similar rates as control group customers. The evaluation found only one significant difference between treatment and control group respondents among the 10 energy-saving practices listed in the survey.² Significantly more control group respondents (11%) reported installing a high-performance heat pump water heater compared to the treatment group (4%). These findings do not align with the evaluation’s impact analysis results, which found significant program savings. Even though the evaluation took steps to minimize bias, such as randomly selecting customers to survey, it is possible that the control group customers who responded to the survey were more energy efficient than the treatment group respondents.

Although the Legacy wave drove the program savings, the Expansion wave showed more engagement and satisfaction with the HERs. Cadmus compared treatment group survey results by the vendor that delivered the customers’ first reports. This allowed the evaluation to compare the Legacy wave (Oracle) to the Expansion wave (Bidgely). Several significant differences emerged between the Oracle wave and Bidgely wave respondents. More Bidgely wave respondents than Oracle wave respondents tended to agree that the energy saving tips were relevant to their home (73% vs. 54%), their household had implemented some of the tips (76% vs. 61%), tended to believe that the similar homes comparison were accurate (69% vs. 35%), and were *very satisfied* with the HERs (36% vs. 21%). The Bidgely wave respondents’ higher engagement with the HERs may be partly explained by the newness of the reports where the tips and information are still new and customers are in the beginning phase of adoption.

Another hypothesis is that the reports for the new Bidgely expansion wave are more accurate than those for the Oracle Legacy wave because the new wave has lower overall consumption, making it easier to come up with relevant tips. For example, in the Bidgely expansion wave, we can rule out with a high degree of confidence that these customers do not have electric heat, whereas the high consumption of the Oracle Legacy wave could mean they have electric or gas heat and/or other appliances that use a lot of electricity.

Customer Awareness of Rocky Mountain Power Programs

The HERs did not have an impact on customers’ awareness of Rocky Mountain Power energy efficiency programs, and the HERs only provided a modest lift in program energy savings and participation. The 2018-2019 HERs promoted Rocky Mountain Power renewable energy programs but not energy efficiency programs. When asked about their general familiarity with energy efficiency

² The energy-saving practices include the following: changed the furnace or air conditioner filter every couple of months; unplugged/turned off electronics or appliances when not in use; kept the heating thermostat to 68 degrees or lower in winter; kept the air conditioning thermostat to 78 degrees or higher in summer; installed a programmable or smart thermostat; weatherized the home; installed an energy-efficient washer or dryer, low-flow showerhead, or aerator; installed high-efficiency heating or cooling equipment; and installed a high-performance heat pump water heater.

programs from Rocky Mountain Power, 43% of treatment group respondents and 38% of control group respondents said they were familiar, a difference that was statistically insignificant.

When asked to identify programs they had heard of, treatment and control group respondents did not significantly differ except for one program. A significantly higher proportion of control group respondents (24%) had heard of the low-income weatherization program compared to the treatment group (7%). These survey results were consistent with findings from the uplift analysis—Cadmus found that the HERs had only a small impact on participation in and savings from Rocky Mountain Power’s downstream rebate programs.

Customer Satisfaction

Customer satisfaction with the HERs improved from the 2015-2016 program years. For Rocky Mountain Power Idaho’s 2018-2019 HER program, 67% of treatment group respondents said they were satisfied with the HERs, and the mean satisfaction rating was 6.8 on a scale from 0 to 10. The 2018-2019 HER program achieved higher customer satisfaction than the 2015-2016 HER program, with which 62% of customers were satisfied.

Overall, customers perceived the HERs very positively, but their perceived accuracy of the similar homes comparison and relevancy of the tips emerged as key areas for program improvement. Most customers agreed that the reports are easy to understand (90%) and the information in the reports is helpful (82%). Rocky Mountain Power Idaho had concerns about customer perceptions of the accuracy of the similar homes comparison because, at the time of program relaunch, the HERs for some customers showed inaccurate similar home comparison information. Bidgely temporarily suspended the HERs after relaunch to correct the error. In the survey, Cadmus asked customers about their belief in the accuracy of the similar homes comparison. Forty-eight percent of respondents agreed with the statement “I believe the similar homes comparison in the reports was accurate.” Notably, fewer respondents *strongly agreed* (13%) than *somewhat agreed* (35%) with the statement. These results suggest that the similar homes comparison component of the HERs could be improved to raise customer confidence and satisfaction. However, customers’ perception of the similar homes comparison are not unique to Rocky Mountain Power Idaho’s program. Other evaluations conducted by Cadmus have found that customer dissatisfaction with the HERs’ similar homes comparison and accuracy are very common for this type of behavior program.

Those who were satisfied with the HERs frequently said the HERs are useful, helpful or informative (18%), they like seeing their usage data (10%), they like the energy saving tips (7%), they like the similar homes comparison (6%), and the report is easy to read (5%). Those who were not satisfied frequently said they dislike the similar homes comparison (32%), the report is not accurate (5%), they want more info or detail in the report (5%), the report is not applicable (4%), and the tips are not applicable or feasible (4%).

The HERs did not appear to impact the high customer satisfaction with Rocky Mountain Power. No statistically significant differences in customer satisfaction with Rocky Mountain Power emerged between the treatment and control groups; 84% of treatment group respondents and 88% of control

group respondents said they were satisfied with Rocky Mountain Power. A similar result was found in the 2015-2016 evaluation that showed there was no significant difference between treatment (87%) and control (87%) group on satisfaction with Rocky Mountain Power.

Cost-Effectiveness

Based on the total resource cost (TRC) and utility cost test (UCT), Rocky Mountain Power Idaho's HER program was cost-effective in 2019, but not in 2018 and came in just under a 1.0 cost-benefit ratio for the two program years combined. Cadmus evaluated TRC and UCT ratios of 0.59 in 2018 (inclusive of program start-up costs), 1.77 in 2019, and 0.98 over the two-year period. That is, for every dollar spent on HER program costs, Rocky Mountain Power Idaho, and its residents, will receive \$0.98 in benefits. If the 2018 start-up costs were removed, the TRC/UCT ratios would increase to 1.35 for 2018 and result in a two-year period TRC/UCT of 1.57.

Recommendations

- Consider promoting energy efficiency programs in the HERs to increase customer awareness of program offerings, help increase participation in energy efficiency programs, and support savings across the portfolio.
- Work with the implementation contractor on diversifying and refining the energy-saving tips to increase customer engagement and relevancy. Some ideas include tracking the status of tips at the customer level (e.g., complete, incomplete, or irrelevant), framing tips as social activities rather than energy-saving activities, and integrating customer segmentation and demographic data (e.g., housing type, income, early adopter).
- Work with the implementation contractor on ways to improve the wording or presentation of the similar homes comparison to increase customer confidence in its accuracy. Consider providing customers with more detail about what goes into the similar homes comparison, A/B testing words or phrases, or provide customers with a quick and easy way to update their home information.
- Consider working with the implementation contractor on adapting the HERs to the changing needs of customers in light of COVID-19. More customers are spending their time at home and have limited opportunities and funds to go out and purchase energy-efficient products. The HER's messaging and tips should reflect this situation, for example by providing no- and low-cost energy-saving tips that customers can easily do while staying at home.
- HER program savings are likely to change because of the COVID-19 pandemic, and these changes may be long-lasting. Continue to track program performance on a frequent basis to monitor the impacts of COVID-19, especially because the Expansion wave launched right before the pandemic was in full force.

Program Description

Since 2014, Rocky Mountain Power's Home Energy Reports (HER) program has been sending energy reports to residential customers in Idaho. The HERs contain information about the customer's home energy consumption and encourage the adoption of energy-saving behaviors and home efficiency improvements.

The HER program evaluation used a randomized controlled trial (RCT) design to randomly assign customers to either a treatment group (who received HERs) or a control group (who did not receive them). Treatment group customers were either mailed or emailed the HERs.³ The program also provided all residential customers (including those in the control group) access to an online energy management portal where they could view details and insights about their home energy use, though neither customer group received specific encouragement in the HERs or elsewhere to use the online portal. Control group's consumption provided an accurate baseline for measuring the HER program's energy savings.

From 2014 through 2017, Oracle Utilities Opower served as the implementation contractor and delivered the HERs to customers. In 2018, the HER program transitioned to a new implementation contractor. During the transition period between implementation contractors, customers only received one HER during the seven months from January 2018 to July 2018. Bidgely began sending customers the new HERs consistently in July 2018. Upon relaunch, Bidgely maintained the treatment and control group assignments that Oracle Utilities Opower had established and launched a new HER experiment beginning in 2019 with a group of previously untreated customers.

Customers were assigned to four cohorts known as "waves" that are based on when they began receiving the HERs:

- Legacy wave received first report in 2014
- Expansion wave received first report in 2019

Table 2 and Table 3 summarize the program design and implementation for 2018 and 2019, showing the counts of customers who received the reports and the number and type of reports sent annually.

Cadmus estimated program savings for each wave and program year in the 2018-2019 evaluation. The estimated savings included the effects of any targeted treatment customers received that control customers did not receive. For the 2018-2019 program year, savings included the effects from customers receiving HERs.

³ Customers with a valid email address receive the HERs via email while customers without a valid email address receive print HERs via mail.

Table 2. 2018 Home Energy Reports Program Design and Implementation

Group and Wave	Program Treatments	Customer Count
Treatment Group		
Legacy Wave	3 print HERs; 5 email HERs	13,458
Total Treatment Group		13,458
Control Group		
Legacy Wave	None	8,952
Total Control Group		8,952

Table 3. 2019 Home Energy Reports Program Design and Implementation

Group and Wave	Program Treatments	Customer Count
Treatment Group		
Legacy Wave	4 print HERs; 12 email HERs	12,747
Expansion Wave	0 print HERs; 7 email HERs	7,897
Total Treatment Group		20,644
Control Group		
Legacy Wave	None	8,478
Expansion Wave	None	5,979
Total Control Group		14,457

Evaluation Objectives and Methodology

Cadmus and PacifiCorp identified the following research objectives for evaluating Rocky Mountain Power Idaho's 2018 and 2019 HER program:

- Evaluate program impacts on energy consumption and gain insight on program performance
- Investigate the lift in other Rocky Mountain Power energy efficiency program participation and energy savings from the HER program
- Understand customers' satisfaction with the HER program and awareness of their energy consumption and other energy efficiency programs
- Determine if the HER program was cost-effective each year and across both years
- Review the extent to which PacifiCorp implemented recommendations from previous evaluations

The subsequent sections provide an overview of the evaluation tasks Cadmus conducted.

Program Manager Interviews

In April 2020, Cadmus conducted interviews with the HER program manager from Rocky Mountain Power and the project manager from Bidgely. Interviews focused on capturing any changes to program design and delivery from the previous implementation contractor, how the program performed during 2018-2019, and any implementation challenges and successes.

Customer Surveys

Cadmus conducted an online survey with treatment and control group customers from June 15 to June 28, 2020. A copy of the customer survey instrument is provided in *Appendix A*.

Survey Design

Cadmus designed the survey to assess the influence of HERs on customers' energy efficiency awareness, engagement with online energy-saving resources, adoption of energy-saving practices, and satisfaction with Rocky Mountain Power. To make valid comparisons between treatment and control group customers, we drafted a single survey instrument, with appropriate skip patterns, such that the survey included identical questions for both groups. However, only treatment group customers were asked questions about their engagement and satisfaction with the HERs.

Cadmus minimized any potential response bias from self-reporting by doing the following:

- Drafting clear and concise questions that are not leading, ambiguous, or double-barreled (asked about two or more unique concepts in the same question)
- Randomizing list-based survey items to reduce order effects
- Designing the survey to last no more than nine minutes to minimize survey fatigue and attrition

Survey Mode and Administration

The survey was administered online. Contacting customers solely through email would not have provided a representative sample of the customers in the program because Rocky Mountain Power does not have valid email addresses for all HER program customers. Treatment group customers for whom the utility did not have email addresses only received print HERs via mail.

To ensure a representative sample for the survey, Cadmus contacted customers by email and postcard. Customers received an email survey invitation with a link to the online survey if Rocky Mountain Power had a valid email address for them and they received the email HERs. Customers received a postcard survey invitation with a link to the online survey if Rocky Mountain Power did not have a valid email address for them and they received only print HERs.

The survey took customers five minutes to complete. To encourage customers to respond, Cadmus offered customers who completed the survey the opportunity to enter a drawing for a chance to win a gift card.

Survey Sampling and Response Rates

Cadmus contacted a random sample of customers stratified by group (treatment or control), channel (email or postcard), and first report vendor wave (Oracle or Bidgely). Table 4 shows the number of customers contacted as well as response rates by group, channel, and vendor wave. The customer survey exceeded its overall target of 270 completed surveys and exceeded its control group targets, but fell slightly short of its treatment group targets. The final sample of survey completes produced estimates with $\pm 4\%$ precision at 90% confidence.

Table 4. Customer Survey Sampling and Response Rates

Group, Channel, and First Report Vendor Wave	Qualified Survey Population	Customers Contacted	Target Completes	Achieved Completes	Response Rate
Treatment-Email-Oracle	5,275	600	35	31	5%
Treatment-Postcard-Oracle	5,221	1,300	35	25	2%
Treatment-Email-Bidgely	6,785	1,000	65	70	7%
Control-Email-Oracle	4,704	600	35	36	6%
Control-Postcard-Oracle	2,708	1,300	35	66	5%
Control-Email-Bidgely	4,942	1,000	65	82	8%
Total	29,635	5,800	270	310	5%

Survey Analysis

For the survey analysis, Cadmus compiled frequency outputs, coded open-end survey responses according to the thematic similarities, and ran statistical significance tests. To determine whether survey results significantly differed between group (treatment or control) and first report vendor wave (Oracle or Bidgely), we compared survey results at the 90% confidence level (or $p \leq 0.10$ significance level). Statistical weights were applied to the survey results by group, report delivery channel (email or mail),

and first report vendor wave to estimate results for the program population. Weighted survey results are indicated by the notation “nw” in this report.

Cadmus compared the survey’s satisfaction results from this 2018-2019 evaluation to the 2015-2016 evaluation.⁴ No evaluation was conducted for the 2017 program year.

Savings Estimation

Cadmus estimated program savings following industry best practices for evaluating residential behavior change programs. These methods use a panel regression analysis of customer bills to estimate the HER program’s electricity savings and to control for differences between customers and all naturally occurring, non-programmatic changes in energy consumption. With adequate sample sizes, these models yield robust, unbiased estimates of savings under a randomized control trial (RCT) program design, wherein customers from the same population are randomized into treatment and control groups. We estimated electricity savings during the 2018 and 2019 program years separately for each wave in the Idaho HER program.

Data Collection and Preparation

Cadmus collected monthly billing data from PacifiCorp, program tracking data including wave and group assignments from the program implementer, and weather data from the National Oceanic and Atmospheric Administration (NOAA). Billing data covered all customers in the experimental design and ranged from July 2011, 12 months prior to the launch of Idaho’s first wave of treatment, through January 2020. Weather data, which included daily temperature readings from weather stations nearest to customers’ zip codes, spanned the same date range. We calculated total heating- and cooling-degree days (HDDs and CDDs) for each customer billing cycle,⁵ then normalized billing usage and monthly HDDs and CDDs to the calendar month for analysis.

Because of the randomized control trial design of the program, we performed limited data screening and customer filtering. We removed customers from the analysis only if the home had fewer than six months of pretreatment monthly consumption bills or did not have any bills in the posttreatment period. Details including an attrition table are provided the in *Appendix B*.

Verification of Group Balance

Cadmus verified that subjects in the randomized treatment and control groups were equivalent in pretreatment energy use. Specifically, we compared average annual pretreatment usage between treatment and control groups in each wave and calculated two-sample t-tests to determine if

⁴ Navigant Consulting, Inc. August 2017. *Idaho Home Energy Reports Program 2015-2016 Evaluation Report*. Submitted to Rocky Mountain Power.
<https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/environment/dsm/idaho/Rocky Mountain Power Idaho HER Evaluation Report final.pdf>

⁵ Cadmus used 65°F as the base temperature for HDD and CDD calculations.

differences were significant. The randomized design of the program should result in groups with statistically indistinguishable average annual usage before treatment begins.

Table 5 provides the results of the t-tests for significant differences in treatment and control group annual pretreatment consumption. We found that both waves were balanced—no statistically significant differences existed between the pretreatment consumption of treatment and control groups.

Table 5. PY10 Tests for Significant Differences in Annual Pretreatment Consumption

Wave	Customers		Average Annual Electricity Use per Customer (kWh/yr)			p-value ⁽¹⁾
	Treatment Group	Control Group	Treatment Group	Control Group	Difference	
Legacy Wave	12,817	8,542	15,736	15,737	1	0.9952
Expansion Wave	7,608	5,478	5,186	5,192	6	0.9106

⁽¹⁾ A p-value >0.05 indicates an insignificant difference at the 5% significance level.

Billing Analysis

Cadmus used regression analyses of monthly billing data from customers in the treatment and control groups to estimate Idaho’s HER Program energy savings. The billing analysis conformed to IPMVP Option C, whole facility,⁶ and the approach described in the Uniform Methods Project.^{7,8} More specifically, we used a multivariate regression to analyze the energy consumption of customers who had been randomly assigned to treatment and control groups. We tested and compared two general model specifications to check the robustness of savings results:

- The **post-only** model regresses customer average daily consumption on a treatment indicator variable and includes as regressors customers’ pretreatment energy use, month-by-year fixed effects and weather.⁹ The model is estimated only with posttreatment customer bills.

⁶ Efficiency Valuation Organization. January 2012. *International Performance Measurement and Verification Protocol, Concepts and Options for Determining Energy and Water Savings, Volume 1*. Page 25. (EVO 10000 – 1:2012) <http://www.evo-world.org/>

⁷ Agnew, K., and M. Goldberg. April 2013. *Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, Chapter 8: Whole-Building Retrofit with Consumption Data Analysis Evaluation Protocol*. U.S. Department of Energy, National Renewable Energy Laboratory. (NREL/SR-7A30-53827) http://www1.eere.energy.gov/office_eere/de_ump_protocols.html

⁸ Stewart, J., and A. Todd. August 2014. *Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, Chapter 17: Residential Behavior Protocol*. U.S. Department of Energy, National Renewable Energy Laboratory. (NREL/SR-7A40-62497) http://www1.eere.energy.gov/office_eere/de_ump_protocols.html

⁹ Allcott, H., and T. Rogers. 2014. “The Short-Run and Long-Run Effects of Behavioral Interventions: Experimental Evidence from Energy Conservation.” *American Economic Review* 104 (10), 3003-3037.

- The ***difference-in-differences (D-in-D) fixed effects*** model regresses average daily consumption on a treatment indicator variable, month-by-year fixed effects, customer fixed effects, and weather. The model is estimated with pretreatment and posttreatment customer bills.

For each specification, Cadmus estimated separate program effects for 2018 and 2019 using ordinary least squares and reported Huber-White standard errors adjusted for correlation within homes. The model specification is provided in *Appendix B*.¹⁰ Both models yielded savings estimates that were within each other’s confidence intervals, meaning that their results were not statistically different (illustrated in Figure B-1 in *Appendix B*). We reported the results of the post-only model, consistent with previous evaluations of Idaho’s HER program.¹¹

Program Total Savings Estimation

Cadmus estimated program savings for the 2018 and 2019 programs years for each wave’s population of treatment group customers as the product of average daily savings per participant and the total number of days treatment group customer accounts were active in each evaluated program year. We multiplied the estimate of average daily savings per customer by the total number of active account days because the savings were estimated across all treatment group customers, including those customers not explicitly flagged as having received treatment according to the program tracking data.

Uplift Analysis

As PacifiCorp’s HER program in Idaho encouraged customers to participate in its other energy efficiency programs, it was expected that the program increased program participation. The increase in energy efficiency program participation is known as efficiency program uplift.

Cadmus estimated the lift in efficiency program participation and savings from the HER program in Idaho. Since savings from efficiency program uplift were measured in both the regression-based estimate of savings (described in the *Savings Estimation* section) and in the impact evaluations of PacifiCorp’s other efficiency programs, the uplift savings will be double-counted unless the savings are subtracted from either the HER program in Idaho or the other efficiency programs. We estimated efficiency program uplift and savings for each of the three participant waves and by program year. We subtracted uplift savings from the evaluated HER program savings to avoid double-counting.

The following sections describe how Cadmus estimated uplift from downstream and upstream rebate programs. Definitions of uplift participation and savings are provided in *Appendix B*.

¹⁰ Evaluators prefer this “post-only” or lagged dependent variable model (over the fixed effects *difference-in-differences* model because the *post-only* model tends to estimate program effects with better precision.

¹¹ Navigant Consulting, Inc. August 2017. *Idaho Home Energy Reports Program 2015-2016 Evaluation Report*. Submitted to Rocky Mountain Power.

<https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/environment/dsm/idaho/Rocky Mountain Power Idaho HER Evaluation Report final.pdf>

Estimating Uplift for Downstream Rebate Programs

To estimate the lift in participation and savings provided by Idaho’s HER program, Cadmus matched HER treatment and control group customers to PacifiCorp’s efficiency program tracking data. Because many measures included in energy efficiency program portfolios have multiyear measure lives, we collected PacifiCorp’s efficiency program tracking data from when the HER program launched through the end of 2019.¹² Each row of the tracking database corresponded to the installation of a specific efficiency measure (e.g., heat pump water heater, attic ceiling insulation) at a premise on a specific date and included premise ID, customer account, location (e.g., street address, city, zip code), PacifiCorp program name, program measure name, installation date, and verified annual savings.

To estimate savings uplift, we made a few adjustments to verified annual savings for measures in the tracking data:

- Prorated savings of non-weather-sensitive measures based on the installation date
- Prorated savings of weather-sensitive measures based on the installation date
- Prorated savings for customers with accounts becoming inactive during the calendar year

We aggregated the measure-tracking data to the customer, energy efficiency program, and evaluation year, and calculated the impacts on participation and efficiency program savings using the definitions described in *Appendix B*.

Estimating Uplift for Upstream Rebate Programs

Unlike for downstream programs, Cadmus could not obtain customer-level program tracking data from PacifiCorp’s upstream lighting rebate program because data are collected at the point-of-sale. To estimate the lift in upstream lighting savings due to the HER program, Cadmus surveyed HER treatment and control group customers about their LED bulb purchases and installations in the last 12 months.

Differences in treatment and control group responses yielded estimates of the number of bulbs purchased and installed motivated by the HER treatment. We adjusted this count by the estimated proportion of LED bulb sales that were program-incented and accounted for the expected portion of the year that each bulb was installed when applying the average annual unit savings as reported in the upstream lighting program tracking data.¹³

Table 6 shows the variables required to calculate upstream lighting (see *Appendix B* for the full equation) and Cadmus’ estimation approach.

¹² The billing analysis captured savings effects from measures that had not exceeded their estimated useful life in the performance period under evaluation.

¹³ We excluded a 98% in-service rate embedded in the Regional Technical Forum per-unit savings.

Table 6. Lighting Uplift Data Sources and Estimation Approach

Variable	Data	Estimation Approach
TE(Q)	Survey responses about quantities of LEDs purchased in the previous 12 months	Compare results from randomized treatment and control group customer surveys
ISR	Survey responses about quantities of LEDs installed in the previous 12 months	Calculate the ratio of the number of installed bulbs over the number of purchased bulbs by group
kWh savings/bulb	Rocky Mountain Power Idaho’s upstream lighting program tracking data	Use the average energy savings per bulb claimed in Rocky Mountain Power Idaho’s upstream lighting tracking data
Time installed	Assumption	Assume six months, as if bulbs were installed at a constant rate over the year
% incented	Survey responses about the number of LEDs purchased and Rocky Mountain Power Idaho’s upstream lighting program tracking data	Estimate the total number of bulbs purchased by the PacifiCorp residential customer population using survey responses and compare to the total number of incented bulbs
Treated customers	PacifiCorp program tracking data	Determine the average number of customers treated, where a customer is considered treated in each month he or she is assigned to the treatment group and has an active account

Cost-Effectiveness Evaluation

For this report, Cadmus conducted five common cost-effectiveness tests: the total resource cost (TRC) test; the utility cost test (UCT); the ratepayer impact measure (RIM) test; the participant cost test (PCT); and the PacifiCorp-TRC (P-TRC) test, which includes a 10% electric benefit environmental adder. Rocky Mountain Power Idaho program stakeholders can use the results of these tests to inform discussions on program planning. Any cost-effectiveness test benefit/cost (B/C) ratio greater than 1.0 indicates a cost-effective program.

Cadmus assessed cost-effectiveness for the 2018 program year, the 2019 program year, and for the two-year period combined. The 2018 program year includes program start-up fees with a new contractor.

We estimated cost-effectiveness based on methods described in the California Standard Practice Manual for assessing energy efficiency programs’ cost-effectiveness.¹⁴ We supplemented this information with PacifiCorp program expenditures, utility-provided economic parameters, and verified energy savings.

PacifiCorp focuses on TRC when considering program design and portfolio decision making. The TRC test estimates the net present value of financial costs and benefits to utilities administering programs and to program participants. The P-TRC serves as the other key test for utility staff when evaluating programs. The PCT, PAC and RIM test are helpful for benchmarking program cost-effectiveness from other stakeholder perspectives.

¹⁴ California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects. July 2002.

Table 7 summarizes the five tests used in this evaluation, their benefits and/or costs, and the perspective from which each test assesses cost-effectiveness.

Table 7. Comparison of Benefits and Costs Included in the Cost-Effectiveness Tests

Test	Perspective	Benefits	Costs
TRC	Society	Present value of electric avoided energy and capacity costs ⁽¹⁾	Program administrative and marketing costs, and incremental measure costs (defined as contractor fees to deliver reports to customers)
P-TRC	Society & Environment	All TRC plus a 10% environmental adder benefit	Same as TRC
PCT	Program Participants	Electric bill savings	None (program is provided free to customer)
UCT	Program Administrator (Utility)	Present value of electric avoided energy and capacity costs ⁽¹⁾	Program administrative, marketing, and incentive costs (defined as contractor fees to deliver reports to customers)
RIM	All Ratepayers (participants and nonparticipants)	Present value of electric avoided energy and capacity costs ⁽¹⁾	Program administrative, marketing, and incentive costs, plus the present value of lost revenues

⁽¹⁾ The present value of electric avoided energy costs includes avoided capacity benefits.

The cost-effectiveness analysis used the following program and measure-level inputs to assess cost-effectiveness:

- Program impacts (energy savings and utility expenditures)
- Avoided energy costs¹⁵
- Residential electric rates
- Annual discount rates
- Annual inflation rates
- Residential energy load shapes
- Effective useful measure life (EUL) of one year

We used Cadmus’ cost-effectiveness tool, PortfolioProPlus, to calculate the HER program’s cost-effectiveness. PortfolioProPlus is a web-based application that sits on top of a relational database that maintains a single source of data for ease of auditing results from prior analyses; modeling measures, programs, and portfolios; and customizing reports and data visualization.

Cadmus’ PortfolioProPlus model employs the California Standard Practice Manual methodology to evaluate cost-effectiveness, utilizing a SQL Server database of measures, hourly end-use load shapes, and hourly avoided costs. Its analyses accommodate use of secondary fuel benefits, externalities, and other energy and non-energy benefits. Cadmus determined appropriate end-use load shapes using the distribution of evaluated HER savings across the calendar year.

¹⁵ Avoided energy costs used in PacifiCorp’s 2017 Integrated Resource Plan, specific to the 2018-2019 biennial evaluation, include capacity price mitigation.

Process Evaluation Findings

The following provides detailed process evaluation findings on Rocky Mountain Power Idaho's 2018-2019 HER program.

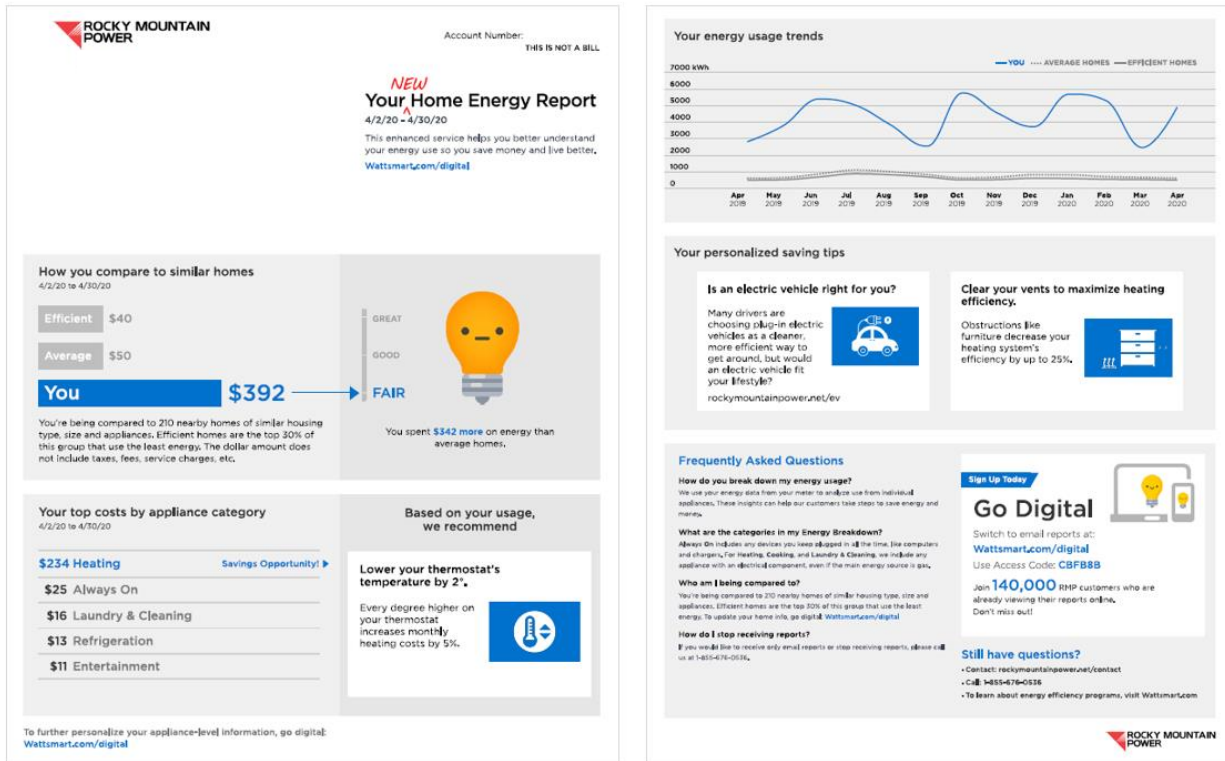
Program Delivery

Three major program delivery changes occurred since the 2015-2016 program. They involved a new implementation contractor, a new HER product, and a new treatment wave.

In 2018, the HER program transitioned to a new implementation contractor, Bidgely. Treatment group customers received the last HERs under the previous implementation contractor (Oracle) in December 2017 and began receiving new HERs from Bidgely in May 2018. Customers experienced a four-month gap in which they did not receive any HERs. Rocky Mountain Power's program manager reported that the program did not meet its 2018 and 2019 savings goal.

The new HERs contained a similar homes comparison, end-use disaggregation cost by appliance, historical energy consumption trends, and personalized energy-saving tips (Figure 1). All but the end-use disaggregation information were found in the previous implementation contractor's HERs. The new HERs connect one of the tips to the end-use disaggregation information to help customers understand where they are using energy and what they can specifically do to reduce consumption.

Figure 1. Copy of 2018-2019 Print Home Energy Report (Front and Back)



While Bidgely used the same RCT design and the Legacy wave as the previous implementation contractor, it launched a new wave in June 2019 (Expansion wave) to increase program savings. Treatment group customers in the Legacy wave received either four print HERs or seven email HERs in 2018, and four print HERs or 12 email HERs in 2019, depending on the availability of a valid email address for the customer. Treatment group customers in the new Expansion wave received seven email HERs in 2019.

Overall, Rocky Mountain Power was satisfied with the HERs and the new implementation contractor. Customers experienced a gap in report deliveries during the change in implementation contractors that spanned January through May 2018. Though the gaps in treatment may have impacted program savings for the Legacy wave in 2018, savings rebounded in 2019. One area of concern was with customer perception of the accuracy of the similar homes comparison. At the initial relaunch of the program in May 2018, Bidgely said it encountered issues in which some customers’ HERs showed inaccurate similar home comparison information. Bidgely resolved the inaccuracies after temporarily halting report delivery, which it resumed in July.

2015-2016 Recommendation Status

As part of the process evaluation, Cadmus reviewed the extent to which PacifiCorp implemented the recommendation from the previous evaluation. Table 8 lists the one recommendation from Rocky Mountain Power Idaho’s 2015-2016 HER program evaluation and progress toward addressing the recommendation.

Table 8. Status of 2015-2016 HER Program Evaluation Recommendations

Recommendation	Status
Future refill waves should target the highest usage customers not already in the program. Prior to adding future refill waves, the program should verify that the allocation of households across the treatment and control groups is consistent with a RCT.	Recommendation not implemented. PacifiCorp did not launch any refill waves for Idaho but did launch a new wave of email-only report recipients in 2019. This new wave required customers to have an email address, have ample historic usage data, reside in a non-multifamily residence, and not have solar.

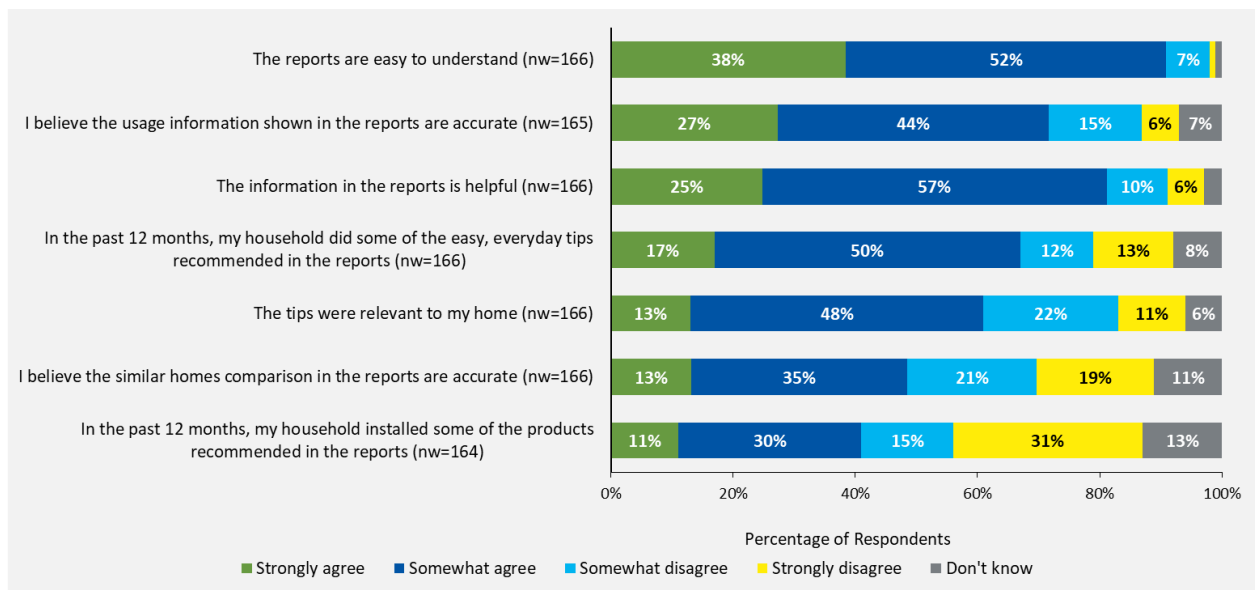
Readership and Perceptions of the Home Energy Reports

Nearly all treatment group respondents (98%) said they read or skimmed the last HER they received (nw=166).¹⁶ Specifically, 38% of respondents said they read the report thoroughly, 30% read some of the report, and 29% skimmed the report. Two percent said they did not read the report.

The survey asked treatment group respondents to indicate their level of agreement on seven positive statements about the helpfulness and relevance of the HERs. Figure 2 shows that the majority of respondents agreed with five of the statements.

¹⁶ Weighted survey results are indicated by the notation “nw” in this report.

Figure 2. Agreement Level to Statements about the Home Energy Reports



Source: Survey Question, “To what extent do you agree or disagree with the following statements about the Home Energy Reports?”

Of the seven statements, the highest proportion of respondents agreed that the reports are easy to understand (90%), the information in the reports is helpful (82%), they believed the usage information shown in the reports was accurate (71%), they had applied some of the everyday tips recommended in the reports (67%), and the tips were relevant to their home (61%).

Fewer respondents agreed with the statements that they believed the similar homes comparison in the reports was accurate (48%) and they had applied some of the products recommended in the reports (41%). Notably, more respondents tended to say they *somewhat agreed* than *strongly agreed*, which suggests that the HERs could still be improved to further increase customer engagement and confidence.

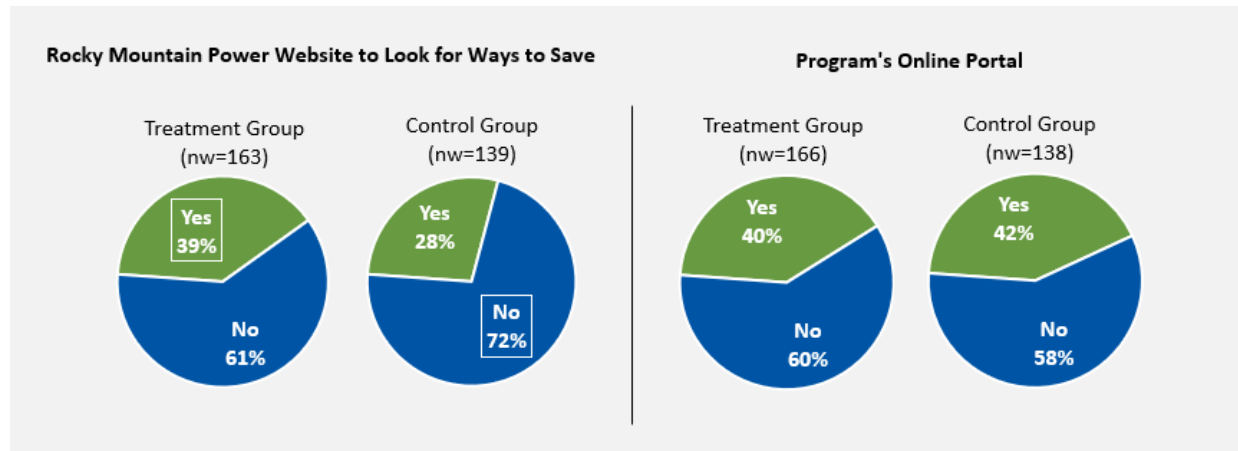
Online Engagement

Treatment group customers received encouragement in the HERs to visit the Rocky Mountain Power website to look for ways to save money on their utility bills and the program’s online portal to view their home’s energy usage and personalized insights about reducing consumption. Control group customers did not receive this encouragement but had the same access to these same online resources. The survey asked treatment and control group customers whether they visited the Rocky Mountain Power website and the online portal in the past 12 months. The evaluation expected to see a higher proportion of visits among the treatment group.

Figure 3 shows that the proportion of treatment and control group respondents who visited the Rocky Mountain Power website differed significantly while the proportions visiting the program’s online portal did not. Significantly more treatment group respondents (39%) than control group respondents (28%)

visited the Rocky Mountain Power website to look for ways to save. A similar proportion of treatment (40%) and control group (42%) reported visiting the program’s online portal.

Figure 3. Self-Reported Visits to Online Resources in the Past 12 months



The **box** indicates a significant difference between groups at the 90% confidence level ($p \leq 0.10$).

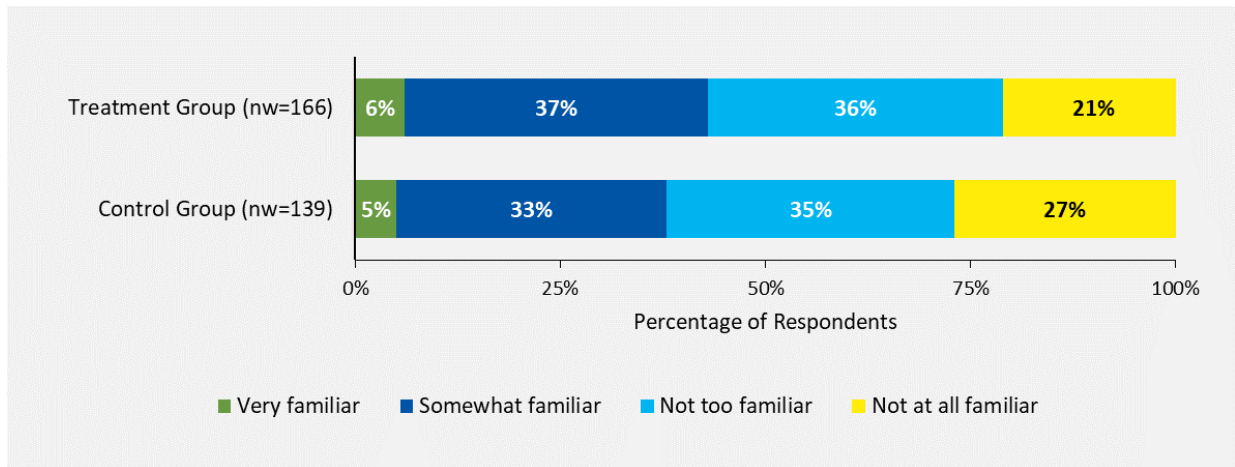
Source: Survey Questions, “In the past 12 months, have you visited the Rocky Mountain Power website to look for ways to save money on your utility bills?” and “Rocky Mountain Power offers its customers access to an online portal where you can see your home’s energy usage along with insights and tips. In the past 12 months, have you accessed this online portal?”

Awareness of Rocky Mountain Power Programs

The 2018-2019 HERs promoted Rocky Mountain Power renewable energy programs but not energy efficiency programs. Additionally, the treatment and control groups had access to the same online resources where they could discover energy efficiency, renewable energy, and demand response programs. Hence, the evaluation did not expect to see any large differences in awareness of programs between treatment and control group.

When asked about their general familiarity with energy efficiency programs from Rocky Mountain Power, 43% of treatment group respondents and 38% of control group respondents said they were familiar (Figure 4). This difference was not statistically significant.

Figure 4. Familiarity with Energy Efficiency Programs

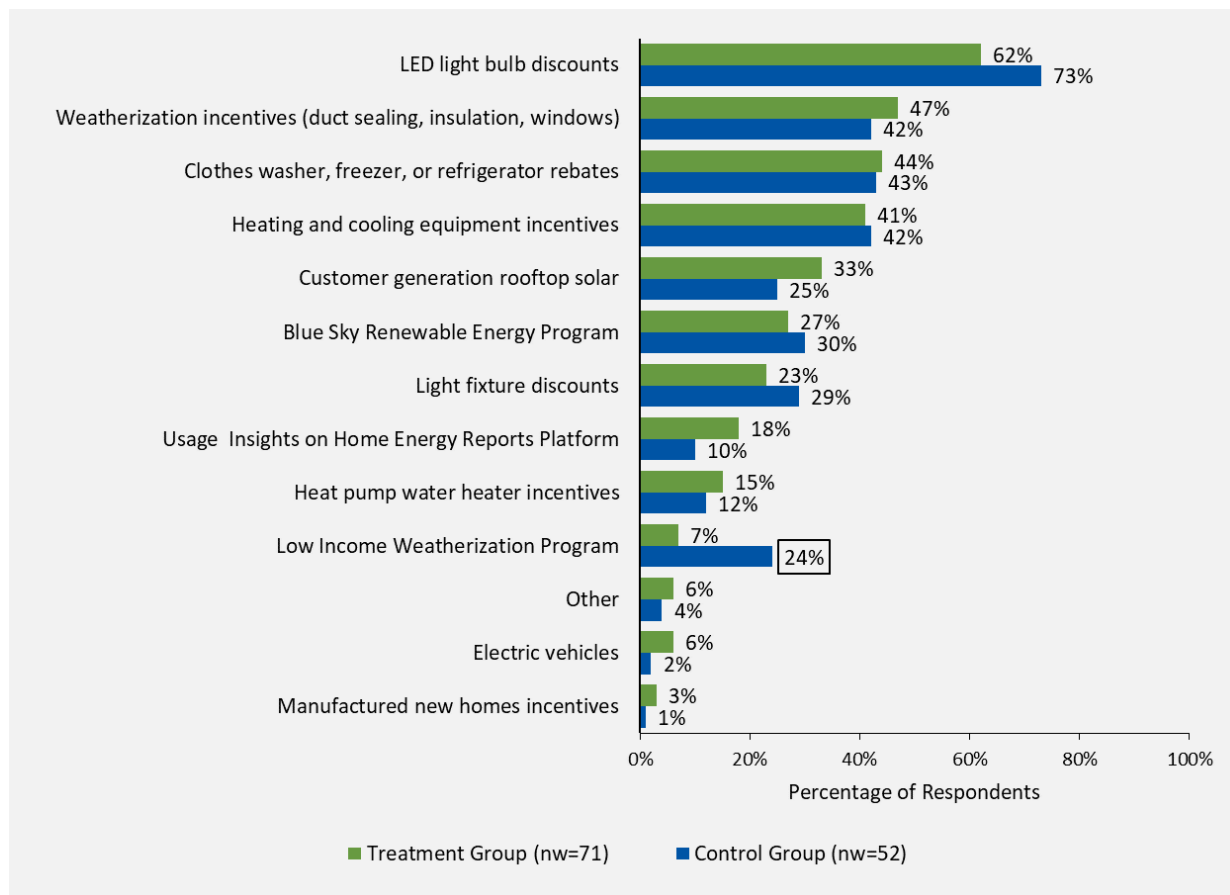


Source: Survey Question, “How familiar are you with energy-efficiency rebates or programs offered by Rocky Mountain Power to help you use less energy?”

Respondents who said they were *very familiar* or *somewhat familiar* were asked a follow-up question to identify from a list the energy efficiency programs they had heard of. Though the question specifically asked about energy efficiency programs, the list included renewable energy and demand response programs.

When energy efficiency program familiarity was asked this way, treatment and control group respondents did not differ significantly except for one program. As shown in Figure 5, a significantly higher proportion of control group respondents (24%) had heard of the low-income weatherization program compared to the treatment group (7%).

Figure 5. Energy Efficiency Programs Customers Have Heard About



The box indicates a significant difference between groups at the 90% confidence level ($p \leq 0.10$).

Source: Survey Question, “Which energy-efficiency rebates or programs from Rocky Mountain Power have you heard about? Select all that apply.”

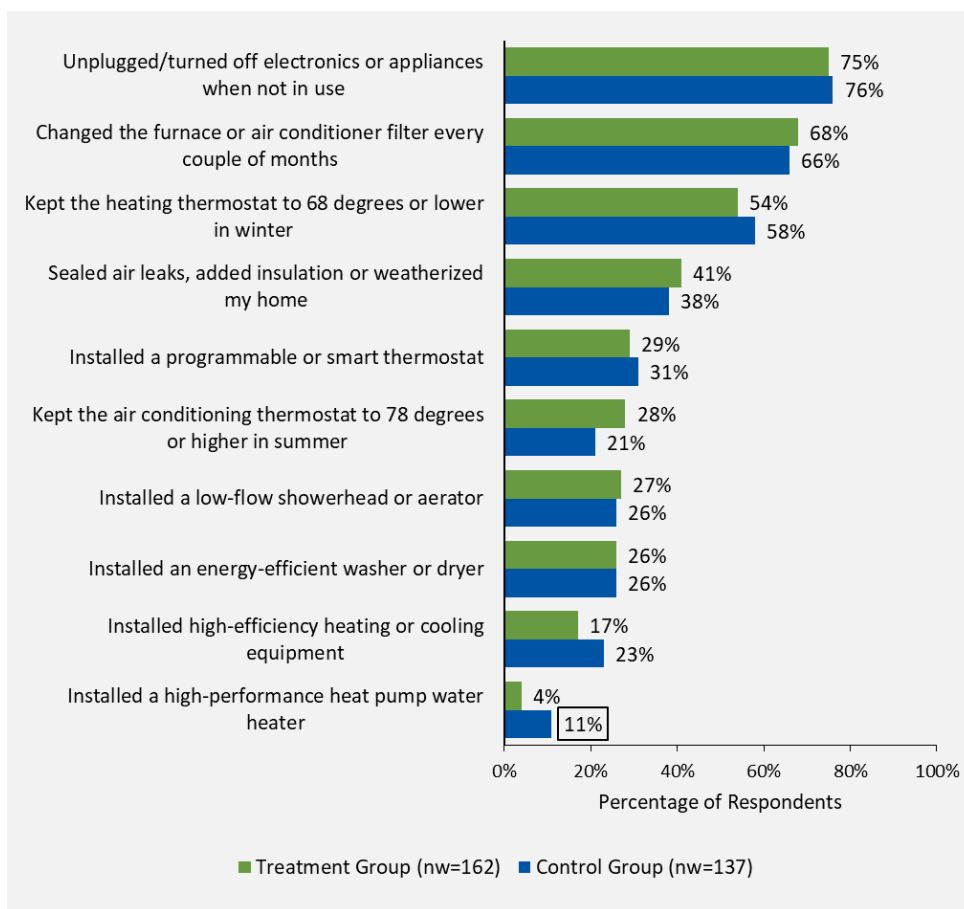
Adoption of Energy-Saving Practices

The survey asked treatment and control group respondents if in the last 12 months they had adopted any of the 10 energy-saving practices listed in Figure 6. The HERs provided treatment group customers with personalized energy-saving tips; therefore, Cadmus expected to see higher self-reported adoption rates from the treatment group.

For all but one of the 10 energy-saving practices, we found no significant differences between treatment and control group respondents. Significantly more control group respondents (11%) reported installing a high-performance heat pump water heater compared to the treatment group (4%).

These self-reported adoption rates of energy-saving practices do not align with the evaluation’s impact analysis results, which found significant savings for the treatment group. Survey response bias could be a reason. Even though we used random sampling to select the survey sample frame, the decision to complete the survey was up to the customer and was not random, and it is possible that control group customers who responded to the survey consisted of those who practiced more energy-efficient activities than the average control group customer.

Figure 6. Adoption of Energy-Saving Practices in the Past 12 Months



The box indicates a significant difference between groups at the 90% confidence level ($p \leq 0.10$).

Source: Survey Question, “For each item, please answer yes or no whether you have done this in the past 12 months.”

Satisfaction with the Home Energy Reports

As shown in Figure 7, 67% of treatment group respondents said they were satisfied with the HERs, and the mean satisfaction rating was 6.8 on a scale from 0 to 10. More respondents said they were *very satisfied* (40%) than *somewhat satisfied* (27%). The 2018-2019 HER program achieved higher customer satisfaction than the 2015-2016 HER program, which observed 62% customer satisfaction.¹⁷

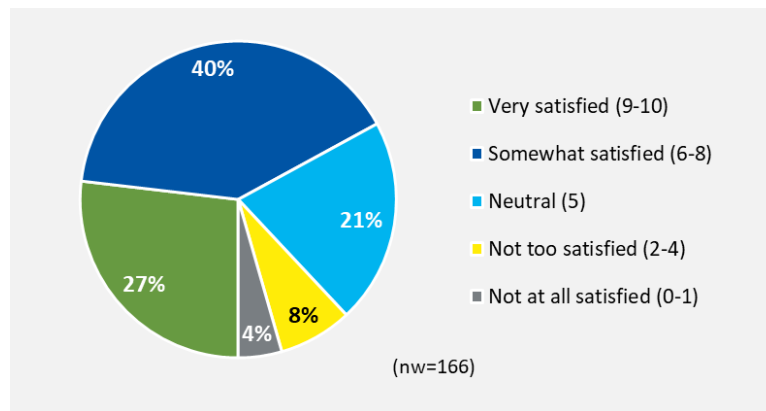
Opt-out behavior programs typically receives some of the lowest customer satisfaction results because customers are automatically enrolled and because it does not offer the incentives that traditional rebate programs offer. Rocky Mountain Power Idaho’s 2018-2019 HER program achieved similar customer

¹⁷ Navigant Consulting, Inc. August 2017. *Idaho Home Energy Reports Program 2015-2016 Evaluation Report*. Submitted to Rocky Mountain Power.

<https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/environment/dsm/idaho/Rocky Mountain Power Idaho HER Evaluation Report final.pdf>

satisfaction compared to other utilities’ HER programs that Cadmus has evaluated in recent years. These other programs have yielded 65% to 78% customer satisfaction.¹⁸

Figure 7. Satisfaction with the Home Energy Reports



Source: Survey Question, “Overall, how satisfied are you with the Home Energy Reports?”

We found through customer open-end comments that the similar homes comparison, perceived accuracy, and personalized energy-saving tips were key areas for improvement. The survey asked respondents open-end questions about their reasons for satisfaction, and 116 respondents answered.

Those who were satisfied frequently said the HERs are useful, helpful, or informative (18%), they like seeing their usage data (10%), they like the energy saving tips (7%), they like the similar homes comparison (6%), and the report is easy to read (5%). Those who were not satisfied frequently said they dislike the similar homes comparison (32%), the report is not accurate (5%), they want more info or detail in the report (5%), the report is not applicable (4%), and the tips are not applicable or feasible (4%).

Reasons for customer dissatisfaction with the HERs are not unique to Rocky Mountain Power Idaho’s program. Other evaluations conducted by Cadmus have found that customer dissatisfaction with the HERs’ similar homes comparison and accuracy are very common for this type of behavior program.

Net Promoter Score: Likelihood to Recommend the Home Energy Reports

The net promoter score (NPS) is a metric of brand loyalty that measures how likely customers are to recommend the program (or product in this case) to others. Respondents rate their likelihood to recommend the product on a 0-10 scale where 0 means “not at all likely” and 10 means “extremely likely.” Respondents giving a rating of 9 or 10 are known as promoters, a rating of 7 or 8 are known as

¹⁸ The comparison includes long-running HER programs from one Midwest utility and one Mid-Atlantic utility. Oracle implemented the Midwest utility’s HER program, which achieved 78% customer satisfaction for 2019. Uplight (formerly Tendril) implemented the Mid-Atlantic utility’s HER program, which achieved 65% customer satisfaction for 2018 and 66% customer satisfaction for 2019.

passives, and a rating of 0 to 6 are known as detractors. The NPS is expressed as a number between -100 and +100 that represents the difference between the percentage of promoters and detractors. The passives are excluded from the calculation. An excellent NPS is +50 and above.¹⁹

As shown in Table 9, the HERs achieved an NPS of -29, indicating there are more detractors (50%) than promoters (21%) among the respondents. According to our research and evaluation of other similar behavior programs, this low NPS is not atypical. We have observed NPS values ranging from -14 to -25.^{20,21} HER programs often experience a lower NPS than traditional rebate programs, possibly because of the opt-out program design and lack of an incentive or equipment-based product.

Table 9. Net Promoter Score: Likelihood to Recommend the Home Energy Reports

Rate Classification	Percentage of Respondents (nw=166)
Promoters (9-10)	21%
Passives (7-8)	29%
Detractors (0-6)	50%
NPS	-29

Satisfaction with Rocky Mountain Power and Energy Services

Because treatment group customers received the HERs, the evaluation hypothesized that the reports lifted customer satisfaction with Rocky Mountain Power. However, no significant differences in satisfaction were detected; 84% of treatment group respondents and 88% of control group said they were satisfied with Rocky Mountain Power. Cadmus observed similar results as the 2015-2016 evaluation in which there was no significant difference between treatment (87%) and control (87%) group on satisfaction with Rocky Mountain Power.²²

¹⁹ Net Promoter, NPS, and Net Promoter Score are trademarks of Satmetrix Systems, Inc., Bain & Company, and Fred Reichheld.

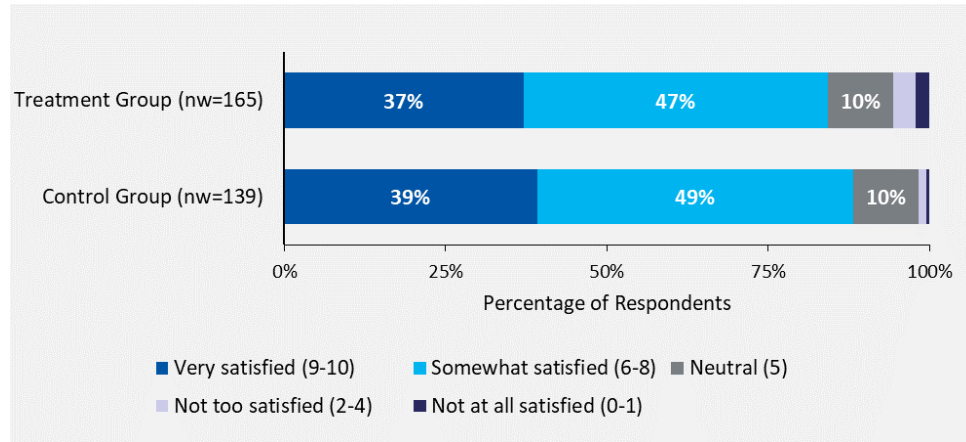
²⁰ PPL Electric Utilities. November 15, 2018. *Annual Report Program Year 9: June 1, 2017–May 31, 2018*. Presented to Pennsylvania Public Utility Commission. Prepared by Cadmus. <http://www.puc.pa.gov/pcdocs/1595564.pdf>

²¹ PPL Electric Utilities. November 15, 2017. *Annual Report Program Year 8: June 1, 2016–May 31, 2017*. Presented to Pennsylvania Public Utility commission. Prepared by Cadmus. <http://www.puc.pa.gov/pcdocs/1544671.pdf>

²² Navigant Consulting, Inc. August 2017. *Idaho Home Energy Reports Program 2015-2016 Evaluation Report*. Submitted to Rocky Mountain Power. <https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/environment/dsm/idaho/Rocky Mountain Power Idaho HER Evaluation Report final.pdf>

Even when comparing the proportions of *very satisfied* and *somewhat satisfied*, responses were similar between treatment and control groups (Figure 8). Also, when calculated as a mean, treatment group (7.7) and control group (7.9) did not significantly differ.

Figure 8. Satisfaction with Rocky Mountain Power



Source: Survey Question, “Overall, how satisfied are you with Rocky Mountain Power?”

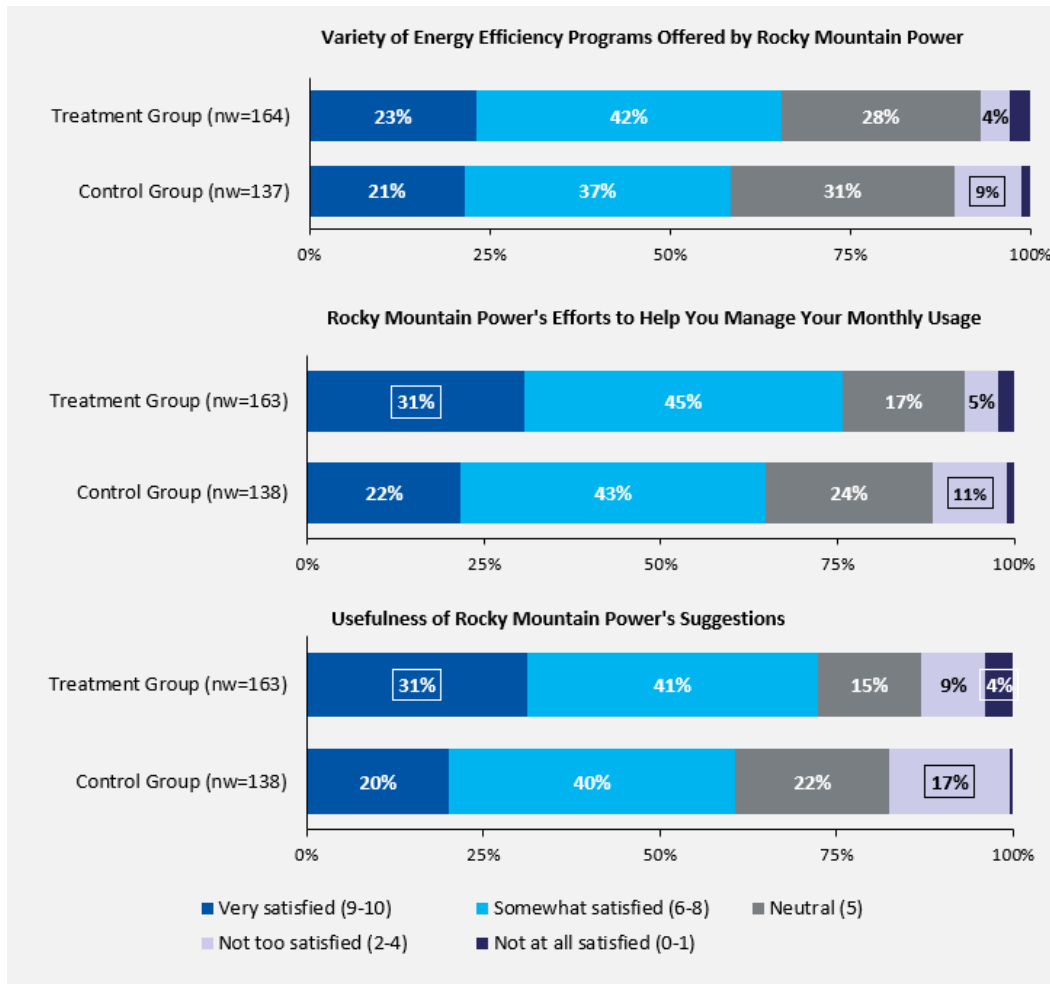
The survey also asked respondents to rate Rocky Mountain Power on the variety of energy efficiency programs it offers, its efforts to help manage monthly usage, and the usefulness of its suggestions to reduce energy usage—collectively known as the J.D. Power categories. We expected to see treatment group respondents give better ratings compared to the control group respondents because the treatment group received the HERs, which informs customers about their energy efficiency and usage and offers suggestions.

Figure 9 shows the rating results for the three J.D. Power categories. In all three categories, a higher proportion of treatment group respondents than control group respondents gave better ratings. All three categories detected significant group differences.

Significantly more treatment group respondents (31%) said they were *very satisfied* with Rocky Mountain Power’s efforts to help manage their monthly usage compared to control group respondents (22%) and significantly more treatment group respondents (31%) said they were *very satisfied* with the usefulness of Rocky Mountain Power’s suggestions compared to the control group respondents (20%). The control group had a significantly higher proportion who said they were *not too satisfied* in all three categories compared to the treatment group.

Notably, the J.D. Power rating questions yielded many *neutral* responses from treatment group respondents (15% to 28%) and control group respondents (22% to 31%), especially for the category of the variety of energy efficiency programs offered by Rocky Mountain Power.

Figure 9. J.D. Power Categories



The box indicates a significant difference between groups at the 90% confidence level ($p \leq 0.10$).

Source: Survey Questions, “How satisfied are you with the variety of energy efficiency programs offered by Rocky Mountain Power?”, “How satisfied are you with Rocky Mountain Power's efforts to help you manage your monthly usage?”, and “How would you rate the usefulness of Rocky Mountain Power's suggestions on ways you can reduce your energy usage and lower your monthly bills?”

Survey Result Comparisons by First Report Vendor

Cadmus analyzed treatment group survey results by the vendor that delivered the customers’ first reports to compare the older wave to the newest wave. The Legacy wave represents the Oracle wave. Treatment group customers in this wave first received HERs generated by Oracle then were switched to receiving the Bidgely HERs in May 2018. The Expansion wave represents the Bidgely wave. Treatment group customers in this wave have received the HERs generated only by Bidgely.

Table 10 shows key survey results by the customers’ first report vendor. Several significant differences emerged in the survey responses of customers in the Oracle wave and Bidgely wave.

More Bidgely wave respondents than Oracle wave respondents tended to agree that the energy saving tips were relevant to their home, their household had implemented some of the tips, tended to believe

that the similar homes comparison were accurate, and were *very satisfied* with the HERs. However, more Oracle wave respondents than Bidgely wave respondents said they read the last report they received.

These significant differences were similar to other Cadmus evaluations of HER programs where customers in the older waves were less satisfied and less engaged with the HERs compared to customers in the newer waves.^{23,24} The Bidgely wave respondents' higher engagement with the HERs can be partly explained by the newness of the reports where the tips and information are still fresh and customers are in the beginning phase of adoption.

Another hypothesis is that the reports for the new Bidgely expansion wave are more accurate than those for the Oracle Legacy wave because the new wave has lower overall consumption, making it easier to come up with relevant tips. For example, in the Bidgely expansion wave, we can rule out with a high degree of confidence that these customers do not have electric heat, whereas the high consumption of the Oracle Legacy wave could mean they have electric or gas heat and/or other appliances that use a lot of electricity.

²³ PPL Electric Utilities. Annual Report Program Year 9: June 1, 2017–May 31, 2018. Presented to Pennsylvania Public Utility Commission. Prepared by Cadmus. November 15, 2018. Available online: <http://www.puc.pa.gov/pcdocs/1595564.pdf>

²⁴ PPL Electric Utilities. Annual Report Program Year 8: June 1, 2016–May 31, 2017. Presented to Pennsylvania Public Utility commission. Prepared by Cadmus. November 15, 2017. Available online: <http://www.puc.pa.gov/pcdocs/1544671.pdf>

Table 10. Survey Result Comparisons between First Report Vendor

Which of the following statements best describes what you did with the last Home Energy Report you received?	Oracle Treatment Waves (nw=100)	Bigdely Treatment Wave (nw=65)
Read the report	100%	94%
Did not read the report	0%	6%
To what extent do you agree or disagree with the following statements? - The tips were relevant to my home	Oracle Treatment Waves (nw=100)	Bigdely Treatment Wave (nw=65)
Agree	54%	73%
Disagree	43%	19%
To what extent do you agree or disagree with the following statements? - In the past 12 months, my household did some of the easy, everyday tips recommended in the reports	Oracle Treatment Waves (nw=100)	Bigdely Treatment Wave (nw=65)
Agree	61%	76%
Disagree	32%	16%
To what extent do you agree or disagree with the following statements? - In the past 12 months, my household installed some of the products recommended in the reports	Oracle Treatment Waves (nw=99)	Bigdely Treatment Wave (nw=65)
Agree	37%	47%
Disagree	53%	36%
To what extent do you agree or disagree with the following statements? - I believe the similar homes comparison in the reports are accurate	Oracle Treatment Waves (nw=100)	Bigdely Treatment Wave (nw=65)
Agree	35%	69%
Disagree	57%	14%
Overall, how satisfied are you with the Home Energy Reports?	Oracle Treatment Waves (nw=100)	Bigdely Treatment Wave (nw=65)
Very satisfied (9-10)	21%	36%
Somewhat satisfied (6-8)	38%	44%
Mean Rating	6.3	7.6
Net Promoter Score: How likely would you be to recommend the Home Energy Reports to a friend, family member, or colleague?	Oracle Treatment Waves (nw=100)	Bigdely Treatment Wave (nw=65)
Promoters (9-10)	17%	27%
Detractors (0-6)	56%	41%
NPS	-39	-14

Note: Blue shading indicates a significant difference between vendor waves at the 90% confidence level ($p \leq 0.10$). Percentages may not add up to 100% because not all answer choices are reported in the table. The answer choices “don’t know” or “no answer” account for the remaining percentage.

Impact Evaluation Findings

The following provides detailed impact evaluation findings on Rocky Mountain Power Idaho’s 2018-2019 HER program, including results from the program savings, uplift, and cost-effectiveness analyses.

Savings Estimation

The following details the results of Cadmus analysis of program energy savings.

Program Total Savings

Table 11 shows the estimates of the average daily savings per customer and program total savings per year with 90% confidence bounds. Cadmus evaluated 2,544 MWh/yr for the program in 2018 and 3,377 MWh/yr for the program in 2019. Notable findings are these:

- The Legacy wave experienced an increase in savings in 2018 and 2019 compared to prior years despite the disruption of treatment for these customers during the first four months of 2018 (see *Program Description* section for details).
- Legacy wave treatment customers reduced their consumption by 1.3% in 2018 and 1.6% in 2019, the largest percentage reductions since treatment began.
- The Expansion wave’s savings in the first year of treatment in 2019 were statistically indistinguishable from 0 kWh/day at a 90% confidence interval.

Table 11. Program Savings by Wave and Program Year ⁽¹⁾

Program Year	Wave	Average Daily Savings per Customer		Program Total Savings (MWh/yr)		
		kWh/day	Percentage ⁽²⁾	Program Savings	90% Lower Bound	90% Upper Bound
2018	Legacy Wave	0.532	1.3%	2,544	1,381	3,707
	Expansion Wave	-	-	-	-	-
	Program Total	-	-	2,544	1,381	3,707
2019	Legacy Wave	0.696	1.6%	3,144	1,848	4,440
	Expansion Wave	0.147	0.6%	233	-36	501
	Program Total	-	-	3,377	2,053	4,700
2019-2019 Program		-	-	5,921	4,159	7,683

⁽¹⁾ Program total savings have not yet been adjusted for uplift.

⁽²⁾ Percentage average daily savings per customer are relative to control group consumption.

Cadmus compared the evaluated savings to those reported by PacifiCorp for the 2018-2019 biennial program. Table 12 shows the evaluated and reported savings for each program year and the realization rate. Program realization rates were below 100% in 2018 and 2019. However, 90% confidence intervals around evaluated savings (shown above in Table 11) include the reported savings for each program year, indicating that evaluated and reported savings were not statistically different.

Table 12. Program Savings Compared to Reported Savings ⁽¹⁾

Program Year	Reported Savings (MWh/yr)	Evaluated Savings (MWh/yr)	Realization Rate
2018	2,802	2,544	91%
2019	3,406	3,377	99%
2018-2019 Program	6,208	5,921	95%

⁽¹⁾ Program total savings have not yet been adjusted for uplift.

Program total savings evaluated for 2018 were slightly lower than savings evaluated in the 2015-2016 evaluation, while evaluated savings for 2019 were slightly higher. The previous evaluator estimated savings as 3,216 MWh/yr for 2015 and 3,103 MWh/yr for 2016. Though in 2018 we found similar average daily savings per customer as evaluated in 2015 and 2016, there were fewer active customers.

Some of this difference is a result of expected attrition from customer account closures. The increase in evaluated savings in 2019 compared to the previous evaluation is because of an increase in average daily savings per customer in the Legacy wave and also the additional customers added to the program through the Expansion wave, which launched in 2019.

Note that additional customers were dropped when the HER program changed implementers during the 2018 program year. According to the interview, the new implementor removed several customers from the program data because of duplicate premise identifiers and addresses and bad mailing or email addresses.

Savings over Time

Table 13 shows the average daily savings per customer by wave for each year of treatment. Savings in the Legacy wave increased in 2018 and 2019 compared to 2017. Absolute savings and savings as a percentage of control-group consumption increased, which may be because of the changes to the reports implemented by the new implementation contractor in 2018.

Table 13. Average Daily Savings per Customers by Wave and Program Year ⁽¹⁾

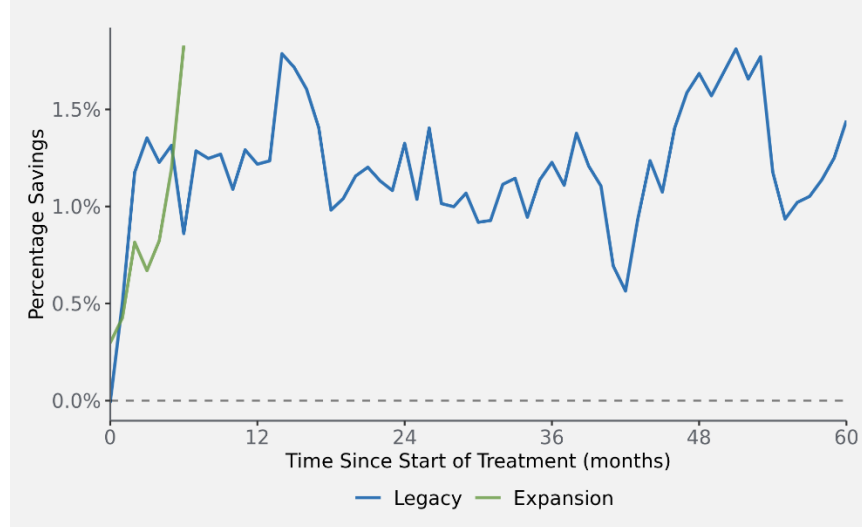
Program Year	Legacy		Expansion	
	kWh/day	Percentage ⁽²⁾	kWh/day	Percentage ⁽²⁾
2014	-0.05 (0.19)	-0.12%	-	-
2015	0.49 (0.09) ***	1.19%	-	-
2016	0.57 (0.12) ***	1.35%	-	-
2017	0.49 (0.14) ***	1.15%	-	-
2018	0.53 (0.15) ***	1.29%	-	-
2019	0.7 (0.17) ***	1.64%	0.15 (0.1)	0.58%

⁽¹⁾ Standard errors clustered on customers are presented after the estimated treatment effect in parentheses (***) Significant at 1%; ** Significant at 5%; * Significant at 10%). The treatment effects represent the average daily savings per treatment group customer.

⁽²⁾ Percentage average daily savings per customer are relative to control group consumption.

Cadmus investigated how savings for each of the waves compared as a function of time since first treatment, as shown in Figure 10. The Expansion wave ramped up savings the fastest after receiving treatment for seven months, although the Legacy wave also ramped up quickly in its first year of treatment. The savings for the Legacy wave has fluctuated over the years but on average converged toward a steady state of savings. The Legacy wave may have experienced a second ramp-up, though differences in weather conditions over the years may cause changes in savings as well.

Figure 10. Percentage Average Daily Savings by Months since First Treatment



Uplift Analysis

The following sections evaluate the lift in participation and savings in other Rocky Mountain Power efficiency programs from HERs.

Savings Uplift

Table 14 shows the lift in savings from HER program customers participating in other PacifiCorp downstream rebate programs. Consistent with findings from the process evaluation, Cadmus found low savings from cross-participation in each of the waves—savings from cross-participation were 5.63 kWh/yr in 2018 and 1.74 kWh/yr in 2019. Although HERs increased savings from participation in downstream energy efficiency rebate programs in 2019, the lift in savings was smaller than in 2018 as the control group increased its efficiency program savings relatively more.

In addition, Cadmus surveyed treatment and control group customers about their LED bulb purchases in the past 12 months to assess the lift from HERs in upstream program savings. However, treatment customers did not purchase or install LED bulbs at statistically higher rates than control customers, and so Cadmus did not make any adjustments to the HER program savings for upstream program uplift.

Overall, the lift in savings from energy efficiency program participation remained small as a percentage of total evaluated savings from the regression analysis. The uplift savings were about 3% of the evaluated HER savings in 2018 and 1% of the evaluated HER savings in 2019.

Table 14. Downstream Savings Uplift Summary

Program Year	Wave	Average Uplift Savings per Customer (kWh/yr)			Total Uplift Savings (MWh/yr)	Percentage of Program Total Savings ⁽¹⁾
		Treatment Group	Control Group	Difference		
2018	Legacy Wave	81.70	76.07	5.63	76	2.98%
	Program Total	-	-	-	76	2.98%
2019	Legacy Wave	106.46	103.53	2.93	37	1.19%
	Expansion Wave	1.35	1.52	-0.17	-1	-0.62%
	Program Total	-	-	-	36	1.06%
2018-2019 Program					112	1.89%

⁽¹⁾ Percentage uplift savings are based on the program total savings shown in Table 11 and Table 12.

Participation Uplift

Table 15 shows the lift in the energy efficiency program participation rate per 1,000 treatment customers and as a percentage of the control group participation rate for the Legacy wave and Expansion wave. Across all waves and program years, Cadmus found that the baseline rate of energy efficiency program participation was 29.03 per 1000 customers. Cadmus defined participation in each year by whether a customer installed at least one measure for which an incentive was provided through a PacifiCorp program in Idaho.

Across both 2018 and 2019 program years, we found that treatment customers participated in programs at a slightly lower rate than control group customers. The difference was -0.41 per 1000 customers, which was equal to about -1% of the baseline participation rate. The Legacy wave participation largely drove the difference in treatment group participation—Legacy treatment customers participated at a lower rate than control group customers in both program years. The lower participation rate for the treatment group may reflect the latter stage of a two-stage process in which HERs initially and temporarily accelerate adoption of energy efficiency measures by treatment group customers followed by period in which treatment group customers adopt measures at a lower rate than control group customers.

Table 15. Downstream Participation Uplift Summary

Program Year	Wave	Control Group Participation Rate (per 1,000 Customers)	Participation Uplift (Treatment Effect on Participation Rate)	Percentage Participation Uplift
2018	Legacy Wave	66.33	-2.27	-3%
	Expansion Wave	-	-	-
	Program Total	66.33	-2.27	-3%
2019	Legacy Wave	6.94	-0.20	-3%
	Expansion Wave	4.34	0.67	15%
	Program Total	5.86	0.19	3%
2018-2019 Program		29.03	-0.41	-1%

Cost-Effectiveness

Table 16 presents cost-effectiveness results for the residential HER program in program year 2018, program 2019, and 2018/2019 combined. Based on the TRC and the UCT tests, the HER program proved cost-effective in 2019, but not in 2018 (1.77 and 0.59 respectively). Over the two-year period, the HER program had a TRC/UCT cost-benefit ratio of 0.98. That is, for every dollar spent on HER program costs, Rocky Mountain Power Idaho, and its residents, will receive \$0.98 in benefits.

These results are lower than previous HER program cost-effectiveness results. The diminished cost-effectiveness likely resulted from the additional program start-up costs when switching implementation contractors during the 2018 program year, which resulted in higher program acquisition costs (\$ per first year net kWh-saved). If the 2018 start-up costs were removed, the TRC/UCT ratios would increase to 1.35 for 2018 and result in a two-year period TRC/UCT of 1.57.

Table 16. Cost-Effectiveness of Residential Home Energy Report Program (2018, 2019, 2018 + 2019)

Cost-Benefit Test	PV Cost (\$) [A]	PV Electric Benefit (\$) [B]	PV Non-Electric Benefit (\$) [C]	Net Benefit (\$) [B+C] - [A]	B/C Ratio [B+C] / [A]
2018					
TRC	\$160,594	\$95,058	-	(\$65,536)	0.59
P-TRC	\$160,594	\$95,058	\$9,505	(\$56,031)	0.65
PCT	-	\$130,713	-	\$130,713	N/A
UCT	\$160,594	\$95,058	-	(\$65,536)	0.59
RIM	\$211,282	\$95,058	-	(\$116,224)	0.45
2019					
TRC	\$78,228	\$138,793	-	\$60,565	1.77
P-TRC	\$78,228	\$138,793	\$13,880	\$74,445	1.95
PCT	-	\$188,061	-	\$188,061	N/A
UCT	\$78,228	\$138,793	-	\$60,565	1.77
RIM	\$146,822	\$95,058	-	(\$51,764)	0.65
2018 + 2019					
TRC	\$238,822	\$233,851	-	(\$4,971)	0.98
P-TRC	\$238,822	\$233,851	\$23,385	\$18,414	1.08
PCT	-	\$318,774	-	\$318,774	N/A
UCT	\$238,822	\$233,851	-	(\$4,971)	0.98
RIM	\$358,104	\$233,851	-	(\$124,253)	0.65

Appendix A. PacifiCorp WY Home Energy Reports Program 2018-2019 Customer Survey

Research Topics	Item Number
Engagement with Rocky Mountain Power’s online energy efficiency resources	C1-C2
Awareness of energy efficiency offerings from Rocky Mountain Power	C3-C4
LED light bulb purchase and installation for upstream lighting	C5-C6
Satisfaction with Rocky Mountain Power	D1
Satisfaction with Rocky Mountain Power’s energy services (J.D. Power questions)	D2-D4
Readership of Home Energy Reports	E1
Behavior change and product adoption from Home Energy Reports	C7, E2C, E2D
Value and relevance of Home Energy Reports	E2A, E2B, E2E, E2F
Satisfaction with Home Energy Reports and Net Promoter Score	E3-E5

Target Audience: Rocky Mountain Power treatment and control group customers in the program

Survey Mode: Online survey using email and postcard distribution

Target Number of Completes Per State:

Assignment	Vendor Waves	Email Target	Postcard Target	Target Total
Treatment Group	Opower Waves	35	35	70
	Bigdely Wave	65	--	65
Control Group	Opower Waves	35	35	70
	Bigdely Wave	65	--	65
Overall Total		200	70	270

Variables to be Pulled into Sample

- PremiseID
- Utility = Rocky Mountain Power
- FirstName
- LastName
- Street Address
- City
- ZIP
- State = WY
- Email
- Phone
- Assignment = Treatment or Control
- VendorWave = Opower or Bigdely
- FirstReportDate
- Channel = Email or Postcard

Treatment Group's Email Invitation to Survey

To: [Email]

From: Cadmus on behalf of Rocky Mountain Power

Subject: Rocky Mountain Power survey offers you a chance for \$100

Dear [FirstName],

Did you receive a Home Energy Report? It's a report that shows your household energy use, energy-savings tips and graphs. Please tell us what you think about the Home Energy Report in a short survey.

When you qualify and complete the survey, you may enter a drawing for a chance to win a \$100 VISA gift card. Two winners will be randomly selected. Your responses will be kept confidential and will never be shared with other parties.

Follow this link to the Survey:

[Survey Link]

Or copy and paste this URL into your internet browser:

[Survey Link]

Rocky Mountain Power has asked The Cadmus Group to administer this survey. If you have any questions about this survey or any difficulties taking the survey, please contact Jeff Abromowitz at (503) 467-7180 or jeff.abromowitz@cadmusgroup.com.

Sincerely,

Shawn Grant

Program Manager, Rocky Mountain Power

Follow the link to opt out of future survey emails:

#{!://OptOutLink?d=Click here to unsubscribe}

Control Group's Email Invitation to Survey

To: [Email]

From: Cadmus on behalf of Rocky Mountain Power

Subject: Rocky Mountain Power survey offers you a chance for \$100

Dear [FirstName],

Will you participate in a short survey to help Rocky Mountain Power make improvements for customers? We understand your time and responses are valuable. **When you qualify and complete the survey, you may enter a drawing for a chance to win a \$100 VISA gift card.** Two winners will be randomly selected. Your responses will be kept confidential and will never be shared with other parties.

Follow this link to the Survey:

[Survey Link]

Or copy and paste this URL into your internet browser:

[Survey Link]

Rocky Mountain Power has asked The Cadmus Group to administer this survey. If you have any questions about this survey or any difficulties taking the survey, please contact Jeff Abromowitz at (503) 467-7180 or jeff.abromowitz@cadmusgroup.com.

Sincerely,
Shawn Grant
Program Manager, Rocky Mountain Power

Follow the link to opt out of future survey emails:
\${!://OptOutLink?d=Click here to unsubscribe}

Treatment Group’s Postcard Invitation to Survey

Side One:

<p>ROCKY MOUNTAIN POWER LOGO CADMUS LOGO</p> <p>Rocky Mountain Power has partnered with The Cadmus Group on this research. For any questions about this research or any difficulties taking the survey, please contact Jeff Abromowitz at (503) 467-7180 or jeff.abromowitz@cadmusgroup.com</p>	<p>FirstName LastName StreetAddress City, State ZIP</p>
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Side Two:

<p>Rocky Mountain Power survey offers you a chance for \$100</p>	<p>Did you receive a Home Energy Report? It’s a report that shows your household energy use, energy-savings tips and graphs. You are part of a small group invited to give feedback about the Home Energy Report in a short survey. When you qualify and complete the survey, you may enter a drawing for a chance to win a \$100 VISA gift card. Two winners will be randomly selected. Can we count on your response?</p> <p>Take the survey at www.energy.cadmusgroup.com/tpowerwy</p> <p>Survey expires on end of day Sunday, June 14, 2020</p>
---	--

Control Group's Postcard Invitation to Survey

Side One:

<p>ROCKY MOUNTAIN POWER LOGO CADMUS LOGO</p> <p>Rocky Mountain Power has partnered with The Cadmus Group on this research. If you have any questions about this research or any difficulties taking the survey, please contact Jeff Abromowitz at (503) 467-7180 or jeff.abromowitz@cadmusgroup.com</p>	<p>FirstName LastName StreetAddress City, State ZIP</p>
--	---

Side Two:

<p>Rocky Mountain Power survey offers you a chance for \$100</p>	<p>Will you participate in a short survey to help Rocky Mountain Power make improvements for customers? You are part of a small group invited to give feedback. When you qualify and complete the survey, you may enter a drawing for a chance to win a \$100 VISA gift card. Two winners will be randomly selected. Can we count on your response?</p> <p>Take the survey at www.energy.cadmusgroup.com/cpowerwy</p> <p>Survey expires on end of day Sunday, June 14, 2020</p>
---	--

A. Survey Start Screen



Welcome! This survey will take about 5 minutes to complete. Your responses will remain confidential and will only be used for research purposes. When you qualify and complete the survey, you may enter the drawing for a chance to win a \$100 VISA gift card.

B. Screener

[Ask if Assignment=Treatment]

- B1. You should have received a document in the mail or your email called a Home Energy Report. This report shows graphs on your home's energy use, comparisons, and energy-savings tips. Do you remember seeing this Home Energy Report? [Forced response]
1. Yes
 2. No [Terminate]

[Ask if Assignment=Control]

- B2. Are you the person who manages or pays the utility bills? [Forced response]
1. Yes
 2. No [Terminate]

Termination Message: Those were all the questions. Thank you for your time.

C. Energy Efficiency Engagement and Awareness

- C1. In the past 12 months, have you visited the Rocky Mountain Power website to look for ways to save money on your utility bills?
1. Yes
 2. No
- C2. Rocky Mountain Power offers its customers access to an online portal where you can see your home's energy usage along with insights and tips. In the past 12 months, have you accessed this online portal?
1. Yes
 2. No

C3. How familiar are you with energy-efficiency rebates or programs offered by Rocky Mountain Power to help you use less energy?

1. Very familiar
2. Somewhat familiar
3. Not too familiar
4. Not at all familiar

[Ask if C3=1 or 2]

C4. Which energy-efficiency rebates or programs from Rocky Mountain Power have you heard about? Select all that apply. [Multiple answers allowed] [Randomize order 1-12]

1. Usage Insights on Home Energy Reports Platform
2. Heating and cooling equipment incentives
3. LED light bulb discounts
4. Light fixture discounts
5. Manufactured new homes incentives
6. Heat pump water heater incentives
7. Blue Sky Renewable Energy Program
8. Customer generation rooftop solar
9. Electric vehicles
10. Clothes washer, freezer, or refrigerator rebates
11. Weatherization incentives (duct sealing, insulation, windows)
12. Low Income Weatherization Program
13. Other (please describe) [Open-end text entry]
14. Don't know [Exclusive answer]

C5. In the past 12 months, about how many LED bulbs have you purchased? Please count the number of individual bulbs, not the number of boxes or packs.

1. [Numeric text entry 0-999]
2. Don't know

[Ask if C5 answer is greater than 0]

C6. Of the [Answer from C5] LED bulbs you purchased, how many are currently in use at your home?

1. [Numeric text entry 0-999]
2. Don't know

C7. For each item, please answer yes or no whether you have done this in the past 12 months.

[Response choices: 1=Yes, 2=No, 3=Not applicable/Don't know] [Randomize order A-J]

- A. Unplugged/turned off electronics or appliances when not in use
- B. Kept the heating thermostat to 68 degrees or lower in winter
- C. Kept the air conditioning thermostat to 78 degrees or higher in summer
- D. Changed the furnace or air conditioner filter every couple of months
- E. Installed an energy-efficient washer or dryer
- F. Installed high-efficiency heating or cooling equipment
- G. Installed a low-flow showerhead or aerator
- H. Sealed air leaks, added insulation or weatherized my home
- I. Installed a programmable or smart thermostat
- J. Installed a high-performance heat pump water heater

D. Energy Service Experience

D1. Overall, how satisfied are you with Rocky Mountain Power?

- 1. 0 – Extremely dissatisfied
- 2. 1
- 3. 2
- 4. 3
- 5. 4
- 6. 5
- 7. 6
- 8. 7
- 9. 8
- 10. 9
- 11. 10 – Extremely satisfied

D2. How satisfied are you with the variety of energy efficiency programs offered by Rocky Mountain Power?

- 1. 0 – Extremely dissatisfied
- 2. 1
- 3. 2
- 4. 3
- 5. 4
- 6. 5
- 7. 6
- 8. 7
- 9. 8
- 10. 9
- 11. 10 – Extremely satisfied

D3. How satisfied are you with Rocky Mountain Power's efforts to help you manage your monthly usage?

1. 0 – Extremely dissatisfied
2. 1
3. 2
4. 3
5. 4
6. 5
7. 6
8. 7
9. 8
10. 9
11. 10 – Extremely satisfied

D4. How would you rate the usefulness of Rocky Mountain Power's suggestions on ways you can reduce your energy usage and lower your monthly bills?

1. 0 – Extremely not useful
2. 1
3. 2
4. 3
5. 4
6. 5
7. 6
8. 7
9. 8
10. 9
11. 10 – Extremely useful

[Ask section E if Assignment=Treatment]

E. Home Energy Reports

These next questions are about the Home Energy Reports. These are the reports you received in the mail or email that shows your household energy use, energy-savings tips and graphs.

E1. Which of the following statements best describes what you did with the last Home Energy Report you received?

1. I read the report thoroughly
2. I read some of the report
3. I skimmed the report
4. I did not read the report
5. Don't know

E2. To what extent do you agree or disagree with the following statements about the Home Energy Reports? [1=Strongly Agree, 2=Somewhat Agree, 3=Somewhat Disagree, 4=Strongly Disagree, 5=Don't know] [Randomize order A-G]

- A. The reports are easy to understand
- B. The information in the reports is helpful
- C. In the past 12 months, my household did some of the easy, everyday tips recommended in the reports
- D. In the past 12 months, my household installed some of the products recommended in the reports
- E. The tips were relevant to my home
- F. I believe the similar homes comparison in the reports are accurate
- G. I believe the usage information shown in the reports are accurate

E3. Overall, how satisfied are you with the Home Energy Reports?

- 1. 0 – Extremely dissatisfied
- 2. 1
- 3. 2
- 4. 3
- 5. 4
- 6. 5
- 7. 6
- 8. 7
- 9. 8
- 10. 9
- 11. 10 – Extremely satisfied

E4. Please tell us why you gave that satisfaction rating for the Home Energy Reports.

[Open-end text entry]

E5. How likely would you be to recommend the Home Energy Reports to a friend, family member, or colleague?

- 1. 0 – Extremely unlikely
- 2. 1
- 3. 2
- 4. 3
- 5. 4
- 6. 5
- 7. 6
- 8. 7
- 9. 8
- 10. 9
- 11. 10 – Extremely likely

F. Gift Card Drawing Entry

F1. Thank you for your time! Before you go, please fill out your name and address to be entered in the drawing for a chance to win a \$100 VISA gift card. Your information will only be used to mail you the gift card in the event that you win. We will not use your information for marketing.

Please complete all the fields below to be entered for the drawing.

1. First and Last Name:
2. Street Address:
3. City:
4. State:
5. ZIP Code:
6. Email Address:
7. Phone Number:

End of Survey Message:

Your responses have been submitted. Thank you!
You will be notified in a few weeks if you are one of the lucky gift card winners.

Appendix B. Impact Evaluation Details

Detailed Methodology and Findings

The following section provide additional details on the evaluation methodology and findings.

Data Preparation

After collecting the billing, weather, and program data, Cadmus took the following steps to prepare the data for analysis.

- *Step 1. Adjust billing data for estimated readings.* Though infrequent, a customer's bills may be based on the utility's estimates of monthly consumption when it cannot read the meter. The first meter reading following a set of consecutive estimated monthly bills includes the consumption for that month and any adjustments required for the previous estimated reads. We adjusted customer billing data for estimated meter readings by aggregated the full set of estimated and actual bills.
- *Step 2. Calculate billing cycle weather.* We collected daily weather data from the National Climatic Data Center (NCDC) and calculated the average degree days (cooling and heating degrees) during each customer billing cycle using average hourly temperature and billing cycle end dates.
- *Step 3. Calendarize consumption.* Using the number of days in the billing cycle, we allocated billing cycle electricity consumption and weather to calendar months and expressed each variable in average daily terms. We dropped any months that were only partially covered by the customers' bills.
- *Step 4. Integrate with program data.* We merged the billing and weather data with HER program and customer information, including the dates when the implementer generated and mailed the reports, dates when customer accounts went inactive, and state, group, and wave assignments.

Because PacifiCorp designed the HER program as an opt-out randomized control trial (RCT), where customers were randomized and automatically enrolled in the program, we performed minimal data screening to maintain the integrity of the experiment. We excluded homes from the analysis sample only when the home had an insufficient number of pretreatment monthly consumption bills. We also dropped each customer's first and last bills, which may start or end at any point during a calendar month and may not cover electricity consumption for the whole month. For customers in the Expansion wave, we removed pretreatment bills that did not have a corresponding month in the posttreatment period since there was not a full year of posttreatment usage data available.

Table B-1 shows the attrition in the 2018 and 2019 analysis sample from the data cleaning steps. The final modeling sample included customers in the tracking data who were not dropped during the billing data cleaning process and included in the regression analysis. These customers had active accounts when delivery of HERs began but they did not necessarily have active accounts at the beginning of treatment in 2018 or 2019. Few customers were dropped during data preparation; Cadmus dropped between 6% and 8% of customers from each group. We estimated savings for the Expansion wave using

a relaxed pretreatment billing history requirement to align with the number of posttreatment bills available in the 2019 program year.

Table B-1. Sample Attrition for Billing Analysis

Step in Attrition	Legacy Wave		Expansion Wave	
	Treatment	Control	Treatment	Control
Included in tracking data	13,503 (100%)	9,038 (100%)	8,400 (100%)	6,000 (100%)
Included in billing data	13,434 (99%)	8,993 (100%)	8,338 (99%)	5,944 (99%)
At least one month of posttreatment bills	13,434 (99%)	8,993 (100%)	7,738 (92%)	5,550 (93%)
At least 11 months of pretreatment bills ⁽¹⁾	12,746 (94%)	8,492 (94%)	7,705 (92%)	5,533 (92%)
Final Modeling Sample	12,746 (94%)	8,492 (94%)	7,705 (92%)	5,533 (92%)

⁽¹⁾ Expansion wave customers with at least 6 months of pretreatment bills were included in the regression analysis.

Model Robustness Checks

Cadmus conducted a billing analysis to estimate average daily savings per customer, as described in the *Billing Analysis* section. We checked if the estimates were robust to changes in model specification, including for the difference-in-differences with customer fixed effects model and the simple-differences post-only, both of which are acceptable methods in the UMP.²⁵ We tested the sensitivity of the estimates by comparing the resulting average daily saving.

Model Specifications

The post-only model was specified assuming the average daily consumption (ADC_{it}) of electricity of home 'i' in month-year 't' as given by Equation B-1. This equation provides a separate estimate of average savings per customer per day for each year of the treatment period.

Equation B-1

$$ADC_{it} = \sum_j \beta_{1j} PART_i * PY_{jt} + \beta_2 Pre-kWh_{im} \times M_m + \gamma W' + \tau_t + \varepsilon_{it}$$

²⁵ Stewart, J., and A. Todd. August 2014. *Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, Chapter 17: Residential Behavior Protocol*. U.S. Department of Energy, National Renewable Energy Laboratory. (NREL/SR-7A40-62497)
http://www1.eere.energy.gov/office_eere/de_ump_protocols.html

Where:

- β_{1j} = Coefficient representing the conditional average treatment effect of the program on electricity use (kWh per customer per day) in program year $j, j = 1, 2, \dots, J$.
- $PART_i$ = Indicator variable that the customer was assigned to the program treatment group (which equals 1 if customer 'i' is in the treatment group and 0 otherwise).
- PY_{jt} = Indicator variable for each program year $j, j = 1, 2, \dots, J$. This variable is equal to 1 if the month-year 't' is in the program year j and 0 otherwise.
- β_2 = Coefficient representing the conditional average effect of pretreatment electricity consumption on posttreatment average daily consumption (kWh per customer per day).
- $Pre-kWh_{im}$ = Mean household energy consumption of customer 'i' in month 'm' of the pretreatment period.
- M_m = Indicator variable for each month ($m = 1, 2, \dots, 12$) in the posttreatment period. The variable M_m equals one if period t is in month m and equals zero otherwise.
- W = Vector of heating degree days and cooling degree days variables to control for the impacts of weather on energy use. HDDs and CDDs were calculated using base temperatures of 65° F.
- γ = Vector of coefficients representing the average impact of weather variables on energy use.
- τ_t = Average energy use in month-year 't' reflecting unobservable factors specific to the month. The analysis controls for these effects with month-by-year fixed effects.
- ϵ_{it} = Error term for customer 'i' in month-year 't.'

The D-in-D fixed effects model was specified assuming the average daily consumption (ADC_{it}) of electricity of customer 'i' in month 't' as given by Equation B-2:

Equation B-2

$$ADC_{it} = \sum_j \beta_{1j} PART_i * POST_t * PY_{jt} + \alpha_i + \tau_t + W'\gamma + \epsilon_{it}$$

Where:

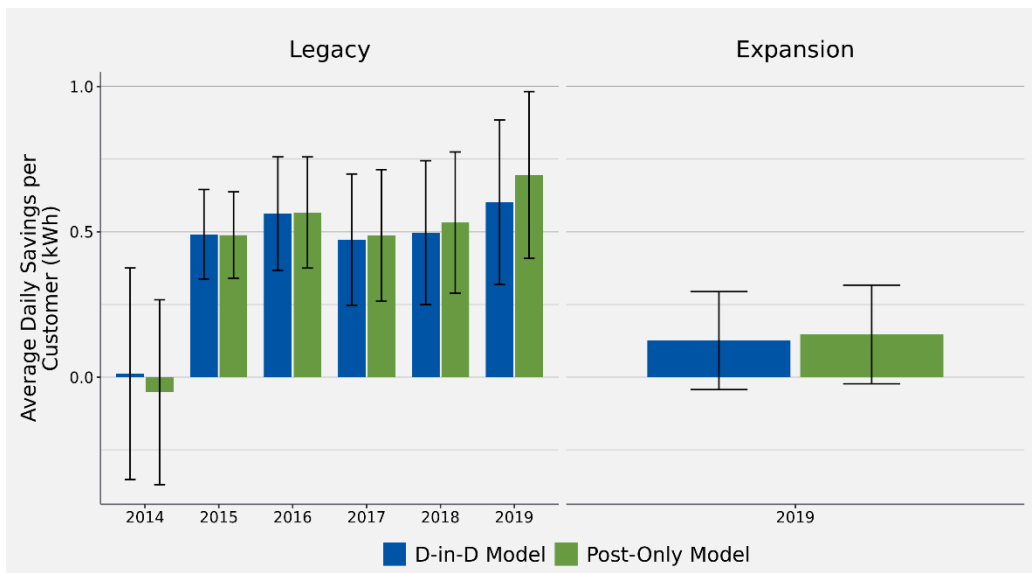
- β_{1j} = Coefficient representing the conditional average treatment effect of the program on electricity use (kWh per customer per day) in program year $j, j = 1, 2, \dots, J$.
- $PART_i$ = Indicator variable for program participation (which equals 1 if customer 'i' was in the treatment group and 0 otherwise).

- $POST_t$ = Indicator variable for whether month 't' is pre- or posttreatment (which equals 1 if month 't' was in the treatment period and 0 otherwise).
- W = Vector of heating degree days and cooling degree days variables to control for the impacts of weather on energy use. HDDs and CDDs were calculated using base temperatures of 65° F.
- γ = Vector of coefficients representing the average impact of weather variables on energy use.
- α_i = Average energy use of customer 'i' reflecting unobservable, non-weather-sensitive, and time-invariant factors specific to the customer. The analysis controlled for these effects with customer fixed effects.
- τ_t = Average energy use in month-year 't' reflecting unobservable factors specific to the month and year. The analysis controlled for these effects with month-by-year fixed effects.
- ϵ_{it} = Error term for customer 'i' in month 't'

Comparison of Model Results

Figure B-1 shows the estimate of average daily savings per customer from both models. The error bars show the 90% confidence intervals. The post-only and the D-in-D estimates are very close, and the confidence intervals for the post-only models include the difference-in-differences estimates across all waves and program years and vice versa, suggesting that the estimates from the two approaches are not significantly different.

Figure B-1. Difference-in-Differences and Post-Only Treatment Effects by Wave and Program Year



For each wave and program year, Table B-2 shows estimates of the average daily treatment effects per customer for both the D-in-D and post-only model specifications. Standard errors around treatment effects are shown in parentheses next to the treatment effects. Both models found statistically

significant savings for most years across the Legacy wave with one exception—savings were not estimated precisely in 2014, during which customers only received one month of treatment. Savings were not estimated precisely for the Expansion wave in 2019, which is likely because it was customers’ first seven months of treatment.

Table B-2. Treatment effects (kWh/day per customers) by Model Specification ⁽¹⁾

Year	Legacy		Expansion	
	D-in-D	Post-Only	D-in-D	Post-Only
2014	0.01 (0.22)	-0.05 (0.19)	-	-
2015	0.49 (0.09) ***	0.49 (0.09) ***	-	-
2016	0.56 (0.12) ***	0.57 (0.12) ***	-	-
2017	0.47 (0.14) ***	0.49 (0.14) ***	-	-
2018	0.50 (0.15) ***	0.53 (0.15) ***	-	-
2019	0.60 (0.17) ***	0.70 (0.17) ***	0.13 (0.1)	0.15 (0.1)

⁽¹⁾ Standard errors clustered on customers are presented after the estimated treatment effect in parentheses (***) Significant at 1%; ** Significant at 5%; * Significant at 10%). The treatment effects represent the average daily savings per treatment group customer.

Savings over Time

Cadmus calculated program total savings for just the years under evaluation, 2018 and 2019, but investigated the changes in average daily savings per customers since each wave launched. The following figures show the point estimates (line) and 90% confidence intervals (blue shaded region) for each month and year of treatment. The vertical line indicates the end of the pretreatment period.

Figure B-2 shows the savings over time for treatment customers in the Legacy wave. The program launched in December 2014. After its first year of treatment, program savings begin to plateau and have remained stable through 2018. Savings experienced a slight degradation in 2018, coinciding with the discontinuation of treatment during the first four months of that year. However, savings recovered in 2019 and increased compared to levels prior to the gap in treatment.

Figure B-2. Average Daily Savings (%) Since Program Launch—Legacy Wave

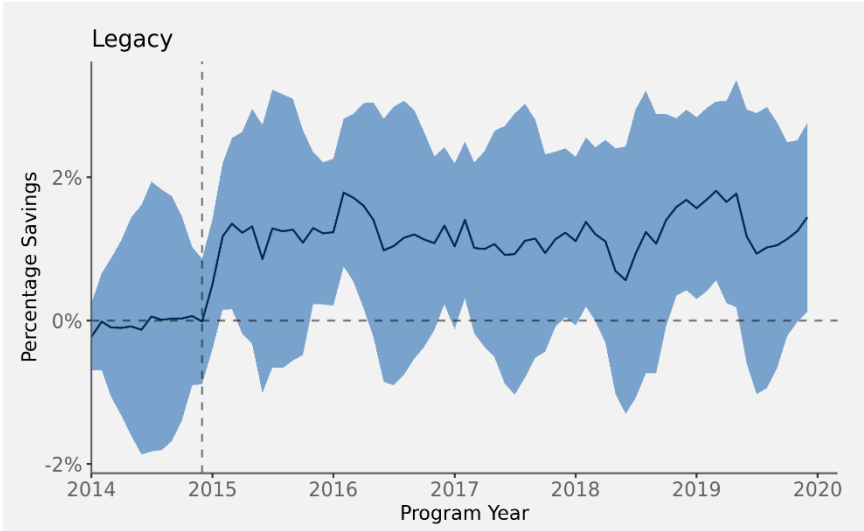
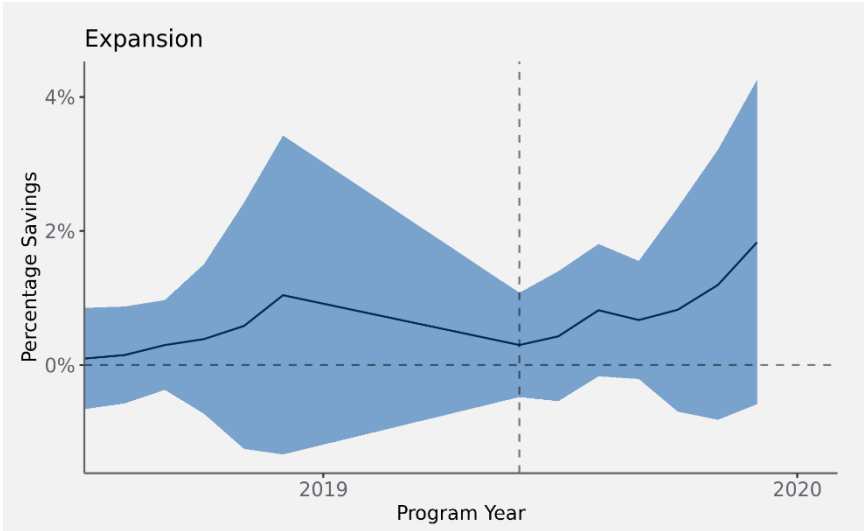


Figure B-3 shows the average daily savings for each month and year of treatment in the Expansion wave. The program launched for these customers in June 2019, and customers quickly ramped up their savings over the next seven months. The Expansion wave is likely still in the ramp-up period and savings are expected to increase as the wave matures.

Figure B-3. Average Daily Savings (%) Since Program Launch—Expansion Wave



Uplift Participation and Savings Definitions

The following sections details Cadmus’ approach to estimating downstream savings and participation uplift and the uplift from Rocky Mountain Power Idaho’s upstream lighting program.

Downstream Participation and Savings Uplift

Cadmus measured the impact of HERs on efficiency program participation as the difference between treatment group customers’ and control group customers’ rates of program participation:

$$\text{Participation Uplift } (\Delta\rho) = \rho_T - \rho_C$$

Where:

ρ_j = The efficiency program participation rate during treatment for group ‘j’ (where $j = T$ for treatment customers and $j = C$ for control customers), with the participation rate defined as the ratio of number of efficiency program participants in the treatment (or control) group to the total number of treatment (or control) group customers

Similarly, we estimated the savings from participation uplift using average efficiency program savings per customer in place of the program participation rate:

$$\text{Uplift savings per customer } (\Delta\sigma) = \sigma_T - \sigma_C$$

where σ_j is the average efficiency program savings per treated (or control) customer.

Multiplying uplift savings per customer by the number of customers assigned to the treatment group (N_T) yielded an estimate of the savings from participation in PacifiCorp’s efficiency program:

$$\text{Program uplift savings} = \Delta\sigma \times N_T$$

Upstream Lighting Uplift

To estimate savings uplift form Rocky Mountain Power Idaho’s upstream lighting rebates program, Cadmus used the equation shown below. Detail on the data sources is provided in the *Estimating Uplift for Upstream Rebate Programs* in the *Evaluation Objectives and Methodology* section.

$$\begin{aligned} &\text{Lighting Savings Uplift} \\ &= TE(Q) \times ISR \times kWh \frac{\text{savings}}{\text{bulb}} \times \text{Time Installed} \times \% \text{ incented} \\ &\times \text{Treated Customers} \end{aligned}$$

Where:

TE(Q)	=	Treatment effect of HER Program on quantity of LED bulbs purchased or received for free
ISR	=	In-service rate (the percentage of purchased LED bulbs installed in sockets in the home)
kWh savings/bulb	=	Annual expected savings per LED bulb

Time installed	=	Average length of time (in years) that purchased bulbs were installed in the program year
% incented	=	Percentage of LED bulbs sold to residential customers that were purchased with a rebate
Treated customers	=	Average number of treated customers during the program year

Cadmus did not find any statistically significant differences in the number of bulbs purchased by treatment and control customers. The 90% confidence intervals around the differences in treatment and control customer bulbs purchased by Legacy wave customers (-1.5 bulbs \pm 4.3 bulbs) and Expansion wave customers included each included zero (-1.3 bulbs \pm 3.1 bulbs).